



SERVICE
MANUAL **150**



marantz

model 150

Am/Fm Stereophonic Tuner

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1. INTRODUCTION

This service manual was prepared for use by Authorized Warranty Stations and contains service information for the Marantz Model 150 Stereophonic Tuner.

Servicing information and voltage data included in this manual are intended for use by the knowledgeable and experienced technician only. All instructions should be read carefully. No attempt should be made to proceed without a good understanding of the operation in the tuner.

The parts list furnishes information by which replacement parts may be ordered from the Marantz Company. A simple description is included for parts which can be usually obtained through local suppliers.

2. AM TUNER

The AM Tuner section in the 150 consists of one IC, including an RF amplifier, local oscillator mixer, IF amplifier, and detector, and three transistors, one of which comprises a signal strength indication amplifier and the other two comprise a detected audio signal amplifier.

All components except the tuning capacitor and ferrite bar antenna are mounted on the printed circuit board P150.

The AM signal induced in the ferrite bar antenna is fed to the RF amplifier input (pin ⑫) and amplified to the level required for overcoming the conversion noises, thus giving good S/N performance. The tuned circuit inserted in each of the output and input circuits of the RF amplifier assures very high image and spurious rejection performance.

Thus the amplified and selected AM signal is then applied to one Mixer input (pin ①). While the local oscillator voltage is injected to the other Mixer input (pin ⑩) through a capacitor C158. Then both AM signal and local oscillator voltage are mixed and converted into 455kHz intermediate frequency. The resulting IF signal is applied to the IF transformer L153 consisting of one ceramic filter and two tuned circuits.

The output of L153 is led to the IF amplifier input (pin ⑨) through a coupling capacitor C159 and amplified to the sufficient level to drive the detector. The detected audio signal derived from pin ⑦ is filtered and amplified, and the final audio output is obtained from the collector of H154 and applied to the output jacks through the function switch and OUTPUT LEVEL controllers RD15/RD16 and output amplifier HD01, HD02. The DC component of the detected IF signal is used as an AGC voltage to control emitter current of RF amplifier through the AGC amplifier incorporated in the IC. A part of the DC component is also led to the signal strength indication amplifier H152. The output appearing at the collector of H152 and is level adjusted by R169, indicated on the display scope H001 through vertical scope amplifier.

2.1 Suggestions for AM Tuner Troubleshooting

Symptom: No reception

Check for broken AM bar antenna, next try to tune stations by rotating the fly-wheel tuning knob slowly and observe the spot on the oscilloscope whether it deflects up and down or not. If the spot moves up and down as you tune past each station, no failure may exist in the stages at least preceding the detector circuit. Next connect a high sensitive oscilloscope to the J009-3 and check for the detected audio signals with the tuner correctly tuned to a station. If the spot does not move up and down when you tune past each station, check the local oscillator circuit. Normal local oscillator output voltage at the hot end of the oscillator tuning capacitor is about 1.5 to 3 volts, depending upon the tuning capacitor position. When measuring the local oscillator output voltage use an RF VTVM, no circuit tester gives correct readings. If the local oscillator output voltage is normal, check all voltage distributions in the AM circuits by using a DC VTVM and compare the measured values with those given in the schematic diagram.

3. FM TUNER

3.1 RF and IF Circuits

The FM Tuner section in the Model 150 is divided into five functional blocks: FM Front End,

IF Amplifier, Detector, Muting Control and MPX Stereo Decoding Circuit.

An FM signal induced by the FM antenna is led to FM antenna coil L101 through the ANTENNA ATTENUATOR switch and Balun coil. The signal is then applied to the dual gate MOS FET RF amplifier which in turn feeds its output to the next dual gate MOS FET Mixer H102 through the triple tuned Butterworth type RF tank circuit. The Mixer converts its input signal into 10.7MHz intermediate frequency and amplifies it at the same time. The H103 is a local oscillator, the output of which is injected into the second gate of the dual gate MOS FET Mixer, through the coupling capacitor C113, the injection voltage being about 700mV. The 10.7MHz front end output is led to the next IF amplifier unit through the coaxial cable.

The IF amplifier unit consists of nine IF amplifier stages (including five IC limiter stages) and one AGC amplifier stage. Four pieces of phase linear IF block filter (one piece of six-pole filter and three pieces of four-pole filter) are also used to obtain high selectivity, and five IC limiter stages are also employed for the best limiting characteristics, improved capture ratio and AM good suppression.

A part of the FM Front End output is applied to the AGC amplifier H201, and the rectified output is fed back to the gate of the dual gate MOS FET RF amplifier to decrease the gain with increased signal strength. The second gate voltage of the dual gate MOS FET RF amplifier is varied by the AGC from about +3.0V at no incoming signal to about -0.5V at a strong incoming signal (100K μ V).

The signals required for multipath indication are obtained from the three IF amplifier stages through the coupling capacitors C220, C225 and C236 respectively and rectified by three pairs of full wave diode circuit. Thus obtained three AM components in the FM signal are appropriately mixed and applied to the vertical amplifier for multipath display.

The IF signal sufficiently amplified through each IF amplifier stage is finally fed to the detector amplifier unit. The detected audio output is led to the buffer amplifier HA02 and its buffered output is led to: (a) the noise amplifier H304 through the resistor R326 and capacitor C334, (b) the QUADRADIAL OUTPUT Jack on the rear panel through the resistor R333, (c) the MPX stereo decoding IC (H301) through R302 and C302.

3.2 MPX Stereo Decoding Circuit

The stereo composite signal from the buffer amplifier undergoes a phase compensation by R302 and C302, is led to the input terminal pin ② of the MPX stereo decoding IC H301 on a PLL (Phase Locked Loop) basis, and is decoded into the left and right stereo signals, which become available at pins 4 and 5, respectively. These decoded left and right stereo audio signals are introduced through a low pass filter consisting of L301 to L304 and C308 to C317 for elimination of undesirable residual switching signal and through a de-emphasis network consisting of R312, R313, C318 and C319 to the audio signal amplifier contained in the muting system IC (H302), where the signals are amplified to a required level for the output from J010-11 and J010-13. From these jacks, the audio signals are further led through the function switch and OUTPUT LEVEL controls RD15/RD16 into the output amplifiers HD01 and HD02, where the signals are amplified to be fed to the output terminals.

Figure 1 presents an internal block diagram showing the functions of the PLL basis MPX stereo decoding IC HA1156. The input stereo composite signal, amplified by the audio amplifier, is delivered to the phase detectors PD-1 and PD-2. A part of the stereo composite signal is also delivered to the stereo decoder section. The VCO (Voltage Control Oscillator) produces a free run oscillation in the neighborhood of 76kHz with the time constant determined by a capacitor C303 and resistors R304 and R305 set on the outside of pin ⑭. The VCO output has its frequency divided into 19kHz through the two frequency divider stages (DIV-1, DIV-2), and is reversed to the phase detector PD-1, which contains two input terminals designed to produce an output in proportion to the product of the two input signals.

The signal led to one PD-1 input is a 19kHz square wave formed through frequency division of the 76kHz VCO output signal by the two frequency divider stages DIV-1, and DIV-2, and the

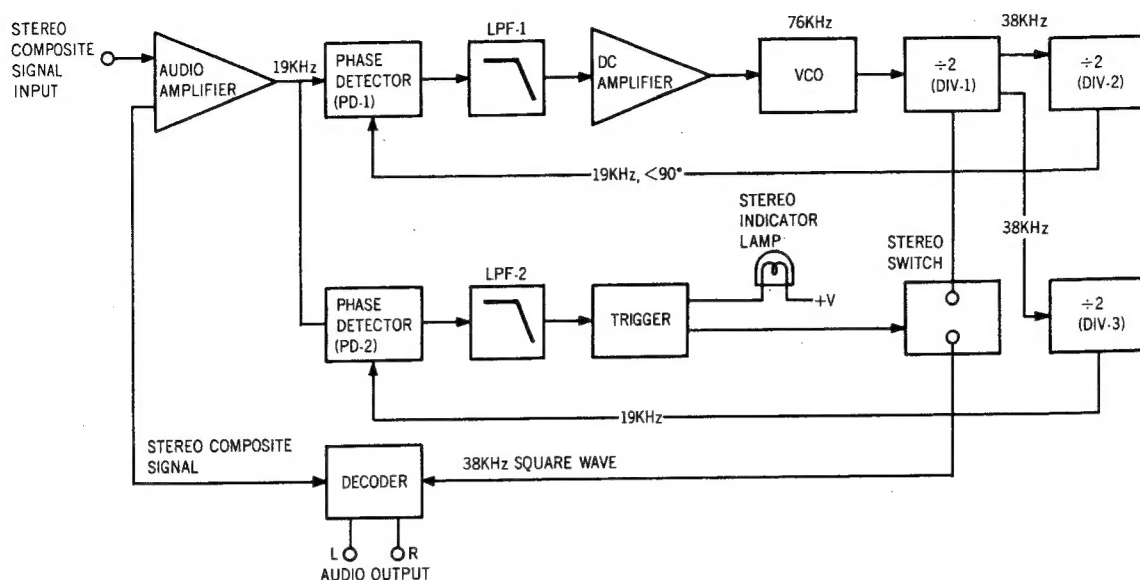


Figure 1. Block Diagram of the HA1156

19kHz pilot signal included in the stereo composite signal as a reference signal is led to the other PD-1 input. Therefore, the output of PD-1 which has passed through the low pass filter LPF-1 provides DC output voltage in proportion to the phase variance between the two inputs. This DC output voltage is amplified by the DC amplifier, and is supplied to the 76kHz VCO as a control voltage. This means that the output frequency and phase of the VCO have been phase-locked to the input pilot signal. The 38kHz sub-carrier reproduced by PLL, as stated above, is delivered through the stereo switch to the stereo decoder section as a switching signal, thus driving the decoder stage. One of the inputs of PD-2 is given the 19kHz resulting from the frequency division completed by DIV-1 and DIV-3, whereas the other input gets the 19kHz output contained in the composite signal, and the output is provided with a DC output in proportion to the amplitude of the pilot signal. This DC output is furnished through LPF-2 to the trigger amplifier which drives the stereo indicator lamp and stereo switch. Therefore, insufficient supply of the pilot signal results in failure to light the stereo indicator and to turn on the stereo switch located in the path of the 38kHz switching signal, thereby avoiding a wrong stereo operation.

H306 fitted on the outside of pin ⑧ is a switching transistor for automatic monaural-stereo switchover. When the intensity of an incoming signal from an FM station is weaker than a predetermined level, this H306 is turned on and pin ⑧ is grounded, thereby developing a condition for monaural reception. For a forced monaural operation, switch the MODE switch to "MONO", and H306 comes into the "On" state with the positive bias voltage applied to the base, and pin ⑧ is grounded, thereby establishing monaural operation.

The transistor H303 connected externally to pin ⑭ is intended to stop the 76kHz oscillation of the VCO which interferes an AM signal during the reception of an AM station. When the function switch is set to "AM" position, a positive bias is charged on the base of H303, H303 is turned on, and pin ⑭ is grounded. Thus, the oscillation of the VCO is stopped, ending the interference with AM reception.

3.3 Audio Muting and Stereo Mode Auto-Selecting Circuit

The muting circuit in the Model 150 consists of one muting system IC, containing almost all functions required for muting operation and 2-channel audio signal amplifier, and two transistors comprising a noise amplifier, and two transistors comprising a trigger voltage shaping circuit.

Three inputs control the muting function. The first is related to the signal strength, the second to the noise condition at the detector, and the third is driven from the DC component of the detector output. These inputs are properly matrixed and gated to provide muting free from noise and transients.

The first input is a DC voltage obtained by rectifying a part of the IF signal output, and is fed through the trigger voltage shaping circuit of H308 and H309 and R340 to the muting system IC (H302) pin ⑥. Pin ⑥ is connected to the base of the muting drive transistor Q19 through the Schmidt trigger and AND circuit within the IC (H302) (see Fig. 2).

The collector of the transistor Q19 is connected to the IC (H302) pin ⑤ within the IC, and is also connected through the MUTING switch, STEREO ONLY switch, R346, and R316 to the IC (H302) pin ②. Pin ② is connected to the base of the muting transistors Q23 (for the L channel) and Q22 (for the R channel) within the IC. The collectors of Q23 and Q22 are connected to pins ① and ③, respectively, within the IC. These pins are connected through the low-pass filter consisting of C321, C320, and L301 to L304 to the MPX stereo decoding IC (H301) output pins 4 (L channel) and 5 (R channel), respectively.

Each signal output of the MPX stereo decoding IC (H301) passes through the low-pass filter and respective capacitors C321 and C320, further passes through respective capacitors C324 and C323, and is then fed to the respective audio signal amplifier input pins ⑩ (L channel) and ⑪ (R channel) on the muting system IC (H302). Each audio signal amplifier magnifies the input signal by approximately 20dB and feeds the output signal to the respective pins ⑭ (L channel) and ⑬ (R channel).

If the IF output signal is greater than the muting threshold level predetermined with the MUTING LEVEL CONTROL switch, the transistor Q19 is turned on by the DC voltage obtained by rectifying a part of the IF output signal led from J010-1 through H309 and H308 to the muting system IC (H302) pin ⑥. Turning on Q19 decreases its collector potential, resulting in turning off the muting switching transistors Q23 and Q22. The MPX stereo decoding IC (H301) output signals, therefore, passes through the low-pass filters and de-emphasis circuits and come to the muting system IC (H302) pins ⑩ and ⑪ without any attenuation in the route. The output signals are then amplified by the audio signal amplifier in the IC (H302) and are fed out of the pins ⑭ and ⑬.

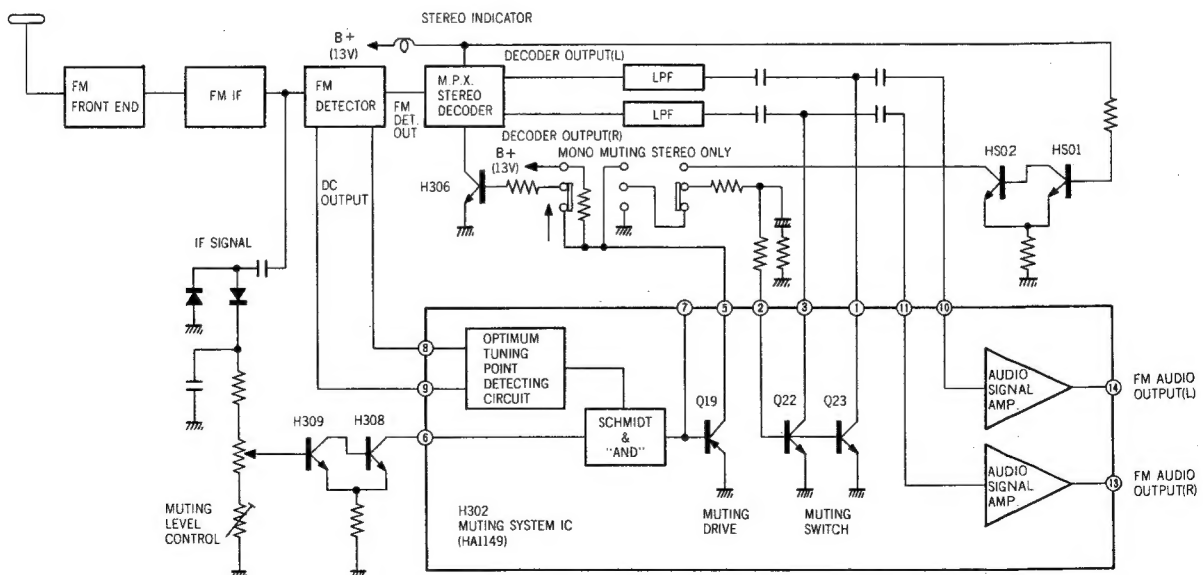


Figure 2. Block Diagram of the Muting System

If the IF output signal is lower than the muting threshold level predetermined with the MUTING LEVEL CONTROL switch, the transistor Q19 keeps the off state and its collector voltage (at the pin ⑤) near the +B voltage (+13V) turns Q23 and Q22 on. Turning on these transistors reduces their collector-emitter resistances to zero ($0\ \Omega$), thereby bypassing the MPX stereo decoding IC (H301) output signals to the ground. The MPX stereo decoding IC (H301) outputs, therefore, cannot come to the muting system IC (H302) pins ⑩ and ⑪, thus no output signals appearing at the pins ⑭ and ⑬.

This is the fundamental principle of the muting operation but for more elaborate muting operation, the second and the third inputs are necessary.

The second input is used to protect the muting operation and MPX stereo beacon lamps from misoperation due to undesirable noises. The high frequency noises included in the detected audio signals are separated by a small capacitor C334 and are amplified by the noise amplifier transistor H304. Its output is rectified by the two diodes. The rectified DC output is proportional to the noise components in the audio signals.

When there are excessive noises in the audio signals such as obtained with a station incorrectly tuned in, the rectified DC output turns the transistor H305 on, decreasing the emitter-collector resistance to zero. This means pin ⑥ of H302 is short-circuited to the ground, therefore is turned off and any audio signals having excessive high frequency noises can not go through the path to pin ⑩ and ⑪.

The collector (pin ⑤) of the transistor Q19 is also connected through the MONO switch to the transistor H306 led to the MPX stereo decoding IC (H301) pin ⑧, and turns it on. Pin ⑧ is therefore grounded equivalently to set the IC in the monaural mode of operation. This prevents misoperation due to undesirable noises when the FM tuner is out of tuning.

When the MONO switch is depressed, an external bias is applied to the base of H306, which keeps the on state irrespective of the strength of the IF output signal and grounds pin ⑧ of H301, thus maintaining the monaural mode of operation at any time.

The third input is fed from the FM discriminator. Since the FM discriminator of the Model 150 is DC floated, the FM discriminator DC output, called the "S" curve, is obtained both from JA01-1 and JA01-2, the polarities at which are inverse from each other (see Fig. 3).

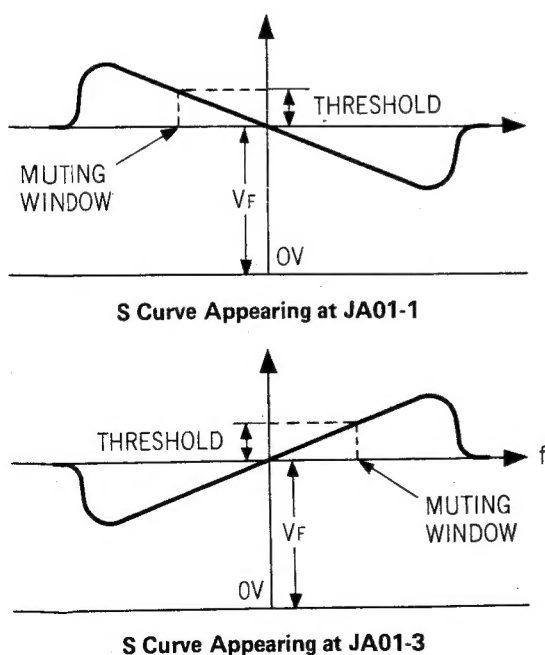


Figure 3. Discriminator DC Output

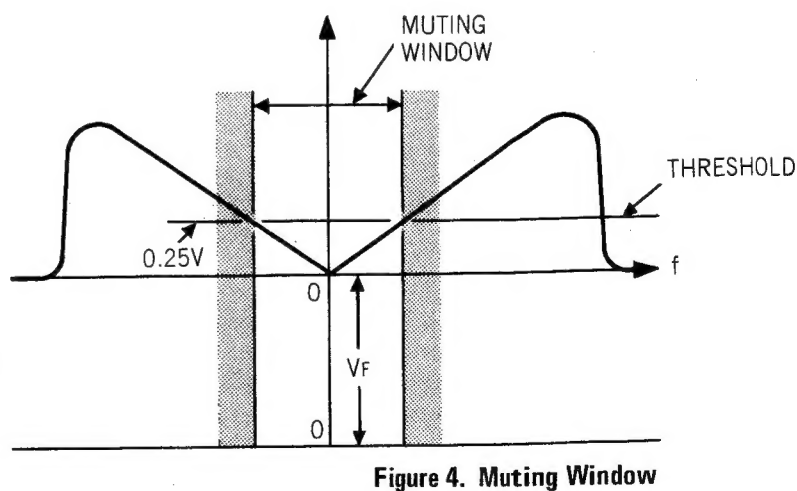


Figure 4. Muting Window

The DC output voltages are led to the "optimum tuning point detecting circuit" input pins ⑧ and ⑨, respectively, of the muting system IC (H302). The output of the "optimum tuning point detecting circuit" is fed through the "AND circuit" to the base of the muting driving transistor Q19. If the DC voltage applied to the muting system IC (H302) pin ⑧ or ⑨ becomes higher than 0.25V, Q19 is turned off, which turns Q23 and Q22 on for muting operation (see Fig. 4).

Thus, when the tuning is shifted or deviated at which undesirable noisy side-audio signals are produced, both muting and monaural/stereo driving transistors Q19 are operated automatically and short-circuited to the ground.

3.4 "Stereo Only" Circuit

The Model 150 provides a capability of selecting and receiving FM stereo broadcast signals only. This function is given by depressing the STEREO ONLY pushswitch. With the pushswitch depressed, the bases (pin ②) of the muting switching transistors Q23 and Q22 are connected through the trigger amplifier of HS02 and HS01 to the MPX stereo decoding IC (H301) stereo indicator lamp drive pin ⑥ (see Fig. 2).

When the stereo indicator lamp illuminates with the Model 150 tuning a stereo broadcast station correctly, the potential at the MPX stereo decoding IC (H301) pin ⑥ is very low (near zero (0) volt) since the internal stereo indicator lamp driving transistor turns on. HS01, therefore, turns off and HS02 turns on, lowering its collector potential down. This maintains Q23 and Q22 in the muting system IC (H302) in the off state, allowing the stereophonic audio signal output to appear at the H302 pins ⑭ and ⑬ normally.

If the Model 150 tunes a monaural station, the stereo indicator lamp does not illuminate, and the potential at the IC (H301) pin ⑥ becomes higher (+13V). This turns HS01 on and HS02 off and turns Q23 and Q22 in H302 on, causing the muting action. Thus, no audio signal outputs appear at pins ⑭ and ⑬. This means all signals except stereo broadcast signals can be muted out.

3.5 Suggestion for Troubleshooting FM Tuner

3.5.1 Symptom: No FM Reception

Turn on (depress) two SCOPE DISPLAY switches "ON" and "TUNING".

First try to tune to some FM stations.

Rotate the fly-wheel tuning knob slowly and observe the spot on the oscilloscope whether or not it follows an approximately rectangular path as you tune past each station. If it moves as described, the tuner circuits preceding the discriminator circuit may have no failure. If not, there would be some defects in the front end or IF amplifier stages, or oscilloscope circuits. To localize the defects in the former case, check the FM local oscillator circuit, using an RF VTVM. The normal local oscillator voltage is one or two volts (rms) at the tuning capacitor, depending on the tuning capacitor position. If the local oscillator voltage is normal, then check all voltage distribution in the front end and IF amplifier stages and compare them with those shown in the circuit diagram.

For localizing the defects in the latter case it is one of methods to apply an audio signal to the SCOPE INPUTS jack (FRONT L or R) on the rear panel with the "EXT 2 CH" SCOPE DISPLAY switch depressed.

The detected audio signals can also be checked by depressing the SCOPE DISPLAY switch "AUDIO" if the scope circuit operates without any defects.

3.5.2 Symptom: No Stereo Separations

First verify that the "MONO" switch is in normal out position.

Connect an FM RF signal generator output modulated by a stereo modulator to the rear FM ANTENNA terminals, and check whether the stereo beacon is turned on or not. If not turned on, check the 19kHz VCO output signal (R311), using an oscilloscope and frequency counter.

4. SCOPE DISPLAY CIRCUIT

Refer to the operating manual on general operating instructions for "SCOPE DISPLAY".

4.1 External Display (2 CH, 4 CH)

a. 2 CH Display

The signal coming into the SCOPE INPUTS terminal FRONT L (FRONT R) on the rear panel is displayed on the scope through the following signal path.

SCOPE INPUTS FRONT L (FRONT R) terminal → R002 (gang variable resistor) → Pin terminal JT06 (JT03) → CT06 (CT08, 0.01μF) → RT28 (RT30, 100 KΩ) → HT05 (HT07, FET) → CT10 (CT12, 10μF) → 2 CH DISPLAY switch → RT19 (RT20, 270 KΩ) → Pin connectors J006-8 and J902-8 (J006-6 & J902-6) → Vertical amplifier (Horizontal Amplifier).

b. 4 CH Display

For the 4 CH display is used a diode matrix circuit consisting of four diodes and twelve resistors. In this circuit, the signals coming into the SCOPE INPUTS terminals FRONT L and R and REAR L and R are arranged to have the same polarity on the positive side and are halved. In turn, the signals are led to the positive or negative side of the differential scope amplifier, in which the signals are individually vector composed and displayed.

Now, the signal path of each channel will be shown when the signals of the same phase and same level are fed to the channels at different times.

b-1 SCOPE INPUTS terminal FRONT L → R002 (Gang variable resistor) → Pin terminal JT06 → CT06 (0.01μF) → RT28 (100 KΩ) → HT05 (FET Pre-Amplifier) → CT10 (10μF) → 2 CH DISPLAY switch → HT04 (Diode) → RT14 (5.6 KΩ) → 4 CH DISPLAY switch → 2 CH DISPLAY switch → Pin connectors J006-8 & J902-8 → Vertical Amplifier (plus side).

→ RT15 (5.6 KΩ) → 4 CH DISPLAY switch → Pin connectors J006-5 & J902-5 → Horizontal Amplifier (minus side).

b-2 SCOPE INPUTS terminal REAR L → R003 (Gang variable resistor) → Pin terminal JT07 → CT07 (0.01μF) → RT29 (100 KΩ) → HT06 (FET Pre-Amplifier) → CT11 (10μF) → HT02 (Diode) → RT08 (5.6 KΩ) → 4 CH DISPLAY switch → Pin connectors J006-9 & J902-9 → Vertical Amplifier (minus side).

→ RT09 (5.6 KΩ) → 4 CH DISPLAY switch → Pin connectors J006-5 & J902-5 → Horizontal Amplifier (plus side).

b-3 SCOPE INPUTS terminal FRONT R → R002 (Gang variable resistor) → Pin terminal JT03 → CT08 (0.01μF) → RT30 (100 KΩ) → HT07 (FET Pre-Amplifier) → CT12 (10μF) → 2 CH DISPLAY switch → HT03 (Diode) → RT10 (5.6 KΩ) → 4 CH DISPLAY switch → 2 CH DISPLAY switch → Pin connectors J006-6 & J902-6 → Horizontal Amplifier (plus side).

→ RT11 (5.6 KΩ) → 4 CH DISPLAY switch → 2 CH DISPLAY switch → Pin connectors J006-8 & J902-8 → Vertical Amplifier (plus side).

b-4 SCOPE INPUTS terminal REAR R → R003 (Gang variable resistor) → Pin terminal JT10 → CT09 (0.01μF) → RT31 (100 KΩ) → HT08 (FET, Pre-Amplifier) → CT13 (10μF) → HT01 (Diode) → RT04 (5.6 KΩ) → 4 CH DISPLAY switch → 2 CH DISPLAY switch → Pin connectors J006-6 & J902-6 → Horizontal Amplifier (plus side).

→ RT05 (5.6 KΩ) → 4 CH DISPLAY switch → Pin connectors J006-9 & J902-9 → Vertical Amplifier (minus side).

4.2 AM Tuning Display

AM signal strength and the correct tuning point are displayed on the scope through the following signal routine:

Rectified DC output at Pin connector J009-9 → FM push switch TUNING DISPLAY switch → RT16 (270 KΩ) → EXT. 4 CH DISPLAY switch → EXT. 2 CH DISPLAY switch → Pin connectors J006-8 & J902-8 → H903 Vertical Amplifier.

4.3 FM Tuning Display

FM signal strength and correct center tuning signals are applied to the oscilloscope's vertical and horizontal deflection plates through the following routines;

- a. Rectified DC output for FM signal strength at the C250 → Pin connector J010-41 → R337 (33 K Ω) → H307 buffer amplifier → R339 (trimming resistor) → Pin connector J010-43 → FM push switch → TUNING DISPLAY switch → RT16 (270 K Ω) → EXT. 4 CH DISPLAY switch → EXT. 2 CH DISPLAY switch → Pin connectors J006-8 & J902-8 → Vertical Amplifier (for signal strength).
- b. DC plus and minus output for center tuning at the Pin connector JA01-3 → Pin terminal JT11 → MULTIPATH DISPLAY switch → RT22 (270 K Ω) → EXT. 4 CH DISPLAY switch → EXT. 2 CH DISPLAY switch → Pin connectors J006-6 & J902-6 → Horizontal amplifier (for center tuning).

Note 1. CT05 is a filtering capacitor for audio signals.

Note 2. For easy-to-see spot display, the display spot is modulated to have a slight length in vertical direction for FM tuning or in horizontal direction for AM tuning. This is done by applying a small amount of AC voltage for pilot lamps to the Vertical (for FM) or Horizontal (for AM) Amplifier input terminal J902-10 or J902-4.

AC voltage for pilot lamps → RT23 → CT01 → TUNING DISPLAY switch FM pushswitch → J902-10 (for FM) or J902-4 (for AM).

* R815 is the DC bias adjusting resistor which corrects the spot position at no signal.

4.4 FM Multi-Path Display

The multi-path display circuit is almost the same as the FM TUNING DISPLAY circuit except the following.

- a. AC voltage for tuning spot modulation is cut off (RT23 and CT01 are disconnected) from the circuit by depressing the MULTI-PATH pushswitch.
- b. Audio signal pass filter (CT05) is also cut off. This means audio signals developed at JA01-3 are fed to the horizontal amplifier.

The vertical signal which contains multi-path information is the same as that of signal strength and led to R339 through the C250.

5. SCOPE CIRCUIT DESCRIPTION

5.1 Vertical Amplifier

The vertical amplifier consists of two direct-coupled differential amplifier stages, the first stage using two FET's (H903, H904) and the second two transistors (H907, H908).

The Vertical Amplifier amplifies signals from DC to AC frequency with very high stability.

The first differential amplifier operates as a source follower and no voltage gain is obtained.

The signal passed the first stage is directly fed to and amplified by the second stage. The gain of the second stage is 47dB for DC signal and 39dB for AC signal. The finally amplified signal is then delivered to the oscilloscope tube.

- * R916 is a gain adjusting resistor and should be set for the gain of 34mV/cm (at 1kHz, 2 CH DISPLAY position).
- * R906 is provided for adjusting DC balance between H903 and H904 and should be set so that the voltage difference between the source terminals of H903 and H904 is less than 0.05V with the vertical centering control knob placed in its mechanical center.

5.2 Horizontal Amplifier

The circuitry of the horizontal amplifier is almost the same as that of the vertical amplifier.

- * R915 is a gain adjusting resistor and should be set for 34mV/cm (at 1kHz, 2 CH DISPLAY position).

- * R905 is the DC balance control between H901 and H902 and should be set so that the voltage difference between source terminals of H901 and H902 is less than 0.05V with the horizontal centering control knob placed in its mechanical center.

6. POWER SUPPLY CIRCUIT

- 6.1 Power source for tuner (+13.5V) and stereo beacon (+12.5V) is zener-regulated and then filtered by a transistor ripple filter circuit consisting of H801.
- 6.2 Power source for Pre-Amp (+36V) is fed through a transistor ripple filter circuit consisting of H802.
- 6.3 Both plus and minus 13.5V DC for the first differential amplifiers are regulated by two zener diodes, H805 and H804, respectively. The same plus 13.5V DC is also used for the external scope amplifier.
- 6.4 Plus 120V DC for the collector circuit of the vertical and horizontal amplifier and minus 970V DC for the CRT's anode are fed by the power supply circuit on P900.
- 6.5 Power sources (plus and minus) for the trace rotation are fed through a resistor R813 and R812 in the power supply circuit on P800.

7. TROUBLE SHOOTING OF OSCILLOSCOPE CIRCUIT

7.1 Symptom: No spot obtained

If no spot is obtained with the CENTERING knobs (V and H) placed in their mechanical center and the BRIGHT control on the rear panel at maximum, there would be defects in the CRT's circuit, vertical and/or horizontal amplifier. To localize the defects proceed as follows:

- a. Short both collector terminals of H907 and H908 and if the spot appear, the vertical amplifier would be defective.
- b. Short both collector terminals of H905 and H906 and if the spot appear, the horizontal amplifier would be defective.
- c. If no spot is obtained yet, the CRT circuit would be defective.

7.2 Symptom: Blurred spot

First adjust the FOCUS control on the rear panel and if no sharp spot is obtained, check whether the voltage between CRT cathode (No. 3 terminal) and plate (No. 4 terminal) can be varied from 44V to 420V or not by adjusting the FOCUS control on the rear panel. If the voltage varies within the limit above, the oscilloscope circuit is normal. Try to replace the CRT with new one.

CAUTION

1. Do not leave the scope turned on with BRIGHT control set maximum.

Do not make the spot left for a long time with its brightness maximum and its focus pin-pointed to avoid possible desensitivity of the phosphor. In the case where the scope has to be turned on for a long time, decrease the brightness of the spot. Turn the scope off when not in use.

2. High Voltage, Danger

When removing the top and/or bottom cover, be sure to remove the power cord from the AC outlet to avoid possible electrical shock from high voltages of the oscilloscope circuit.

3. Do not place the set (CRT) in a powerful magnetic field.

If placed, the electron beam in the CRT will be bent and the spot is shifted from the correct position. The trace may also be distorted.

8. SCOPE DISPLAY ALIGNMENT

8.1 Depress both SCOPE DISPLAY switches "ON" and "EXT. 2 CH".

8.2 Adjust two CENTERING knobs to bring the spot into the center of small circular.

- 8.3 Adjust the "BRIGHT" control (R005) on the rear panel to make the brightness of the spot dimmer.
- 8.4 Adjust the "FOCUS" control (R004) to make the spot smaller and more circular.
- 8.5 Feed in 130mV (1kHz) to the "SCOPE INPUTS, FRONT R" jack and adjust R915 (HORIZ) to obtain a horizontal deflection of about 4cm, then connect the same input voltage to the "VERT" jack and adjust R916 (VERT) for the same vertical deflection.
- 8.6 Set both the centering knobs to their mechanical center, and adjust R905 (HORIZ) and R906 (VERT) to bring the spot into the center of small circular.

9. AM TUNING DISPLAY ALIGNMENT

- 9.1 Depress both SCOPE DISPLAY switches "ON" and "TUNING" and MODE SELECTION switch "AM".
- 9.2 Adjust R815 to bring the spot on the lower center of the base line with no station tuned in.

10. FM TUNING DISPLAY ALIGNMENT

- 10.1 Depress both SCOPE DISPLAY switches "ON" and "TUNING" and MODE SELECTION switch "FM".
- 10.2 Connect an FM signal input of 100K μ V (98MHz, 400Hz, 30% Mod.) to the FM ANTENNA terminals and adjust so that the spot does not frame out.
- 10.3 FM Multipath display alignment: Adjust RA24 to obtain full deflection of the trace within both side marks, applying an FM signal (1K μ V, 400Hz, 100% Mod.) to the FM ANTENNA terminals.

11. AM ALIGNMENT

AM IF Alignment:

- 11.1 Connect a sweep generator to J009-15 and alignment scope to the J009-3.
- 11.2 Rotate the core of the IF transformer L153 for maximum height and flat top symmetrical response.

AM Frequency Range and Tracking Alignment:

- 11.3 Set an AM signal generator to 515kHz. Turn the tuning capacitor fully closed (place the tuning pointer at the low end.) and adjust the oscillator coil L152 for maximum audio output.
- 11.4 Set the signal generator to 1650kHz. Place the tuning pointer in the high frequency end and adjust the oscillator trimmer on the oscillator tuning capacitor for maximum audio output.
- 11.5 Repeat Steps 11.3 and 11.4 until no further adjustment is necessary.
- 11.6 Set the generator to 600kHz and tune the receiver to the same frequency. Adjust a slug core of the AM ferrite rod antenna and RF coil L151 for maximum output.
- 11.7 Set the generator to 1400kHz and tune the receiver to the same frequency. Adjust both trimming capacitors of the Antenna and RF tuned circuit for maximum output.
- 11.8 Repeat Steps 11.6 and 11.7 until no further adjustment is necessary.
Note: During tracking alignment, reduce the signal generator output as necessary to avoid AGC action.
- 11.9 AM Signal Strength Display Adjustment:
Set the AM signal generator to 1000kHz, 100K μ V and adjust R169 so that the spot may meet upper mark.

12. FM ALIGNMENT

- 12.1 Connect an FM signal generator to the FM ANTENNA terminals and an oscilloscope and an audio distortion analyzer to the TUNER OUTPUT jacks on the rear panel.

- 12.2 Set the generator to 87.4MHz and provide about 3 to 5 μ V output. Place the tuning pointer at the low frequency end by rotating the tuning knob and adjust the core of the oscillator coil L105 to obtain maximum audio output.
- 12.3 Set the generator to 108.6MHz and provide about 3 to 5 μ V output. Rotate the tuning knob and place the tuning pointer at the high frequency end. Adjust the trimming capacitor C105 for maximum output.
- 12.4 Repeat Steps 12.2 and 12.3 until no further adjustment is necessary.
- 12.5 Set the generator to 90MHz and tune the receiver to the same frequency. Decrease the signal generator output until the audio output level decreases with the decreasing generator output. Adjust the antenna coil L101, RF coils L102, L103 and L104 and IF transformer L106 for minimum audio distortion.
- 12.6 Set the generator to 106MHz and tune the receiver to the same frequency. Adjust the trimming capacitor C101, C102, C103 and C104 for minimum distortion.
- 12.7 Repeat Steps 12.5 and 12.6 until no further adjustment is necessary.
- 12.8 Connect a VTVM (with DC 1V range) across the pin connector JA01-3 and common ground. Adjust the secondary core (upper) of the discriminator transformer LA01 so that the VTVM indicates null reading (zero reading) at no signal. Set the generator to 98MHz and increase its output level to 1K μ V and tune the receiver to the same frequency so that the VTVM gives null reading. Next adjust the primary core (bottom) of LA01 for minimum distortion. (Scope display can, of course, be used as tuning indicator instead of the VTVM, if the scope unit has been correctly adjusted as instructed in the SCOPE DISPLAY ALIGNMENT.)

13. STEREO SEPARATION ALIGNMENT

- 13.1 Set an FM signal generator to provide 1K μ V at 98MHz. Tune the receiver to the same frequency so that the tuning pointer indicates its center. Then, turn off the modulation of the generator. Connect a frequency counter to the test point R311 (point ©) and adjust R304 so that the frequency counter may precisely read 19kHz.
- 13.2 Modulate the generator with a stereo composite signal consisting of only L or R channel (pilot signal must be included).
- 13.3 Adjust the trimming resistor R302 for maximum and same separation in both channels.

14. FM DOLBY LEVEL ADJUSTMENT

- 14.1 Set an FM signal generator to provide a 400Hz, 50% modulated 1K μ V output.
- 14.2 Connect the generator to the FM ANTENNA terminals and connect a VTVM to the TUNER OUTPUT jacks on the rear panel.
- 14.3 Depress the MODE SELECTION switches "FM" and "DOLBY FM" in and depress the SCOPE DISPLAY switches "ON" and "TUNING" in.
- 14.4 Set the generator to 98MHz and tune the receiver to the same frequency. Adjust and lock RS02 and RS01 until the VTVM connected to L CH and R CH outputs may read 580mV.

15. TEST EQUIPMENT REQUIRED FOR SERVICING

Table 1 lists the test equipment required for servicing the Model 150 Tuner.

Item	Manufacturer and Model No.	Use
AM Signal Generator		Signal source for AM alignment.
Test Loop		Used with AM Signal generator.
FM Signal Generator	Less than 0.3% distortion.	Signal source for FM alignment.
Stereo Modulator	Less than 0.3% distortion.	Stereo separation alignment and trouble shooting.
Frequency Counter		MPX oscillator Adjustment (VCO).
Audio Oscillator	Weston Model CVO-100P, less than 0.02% residual distortion is required.	Sinewave and squarewave signal source.
Oscilloscope	High sensitivity with DC horizontal and vertical amplifiers.	Waveform analysis and trouble shooting.
VTVM	With AC, DC, RF range.	Voltage measurements.
Circuit Tester		Trouble shooting.

Table 1. Test Equipment Required for Servicing

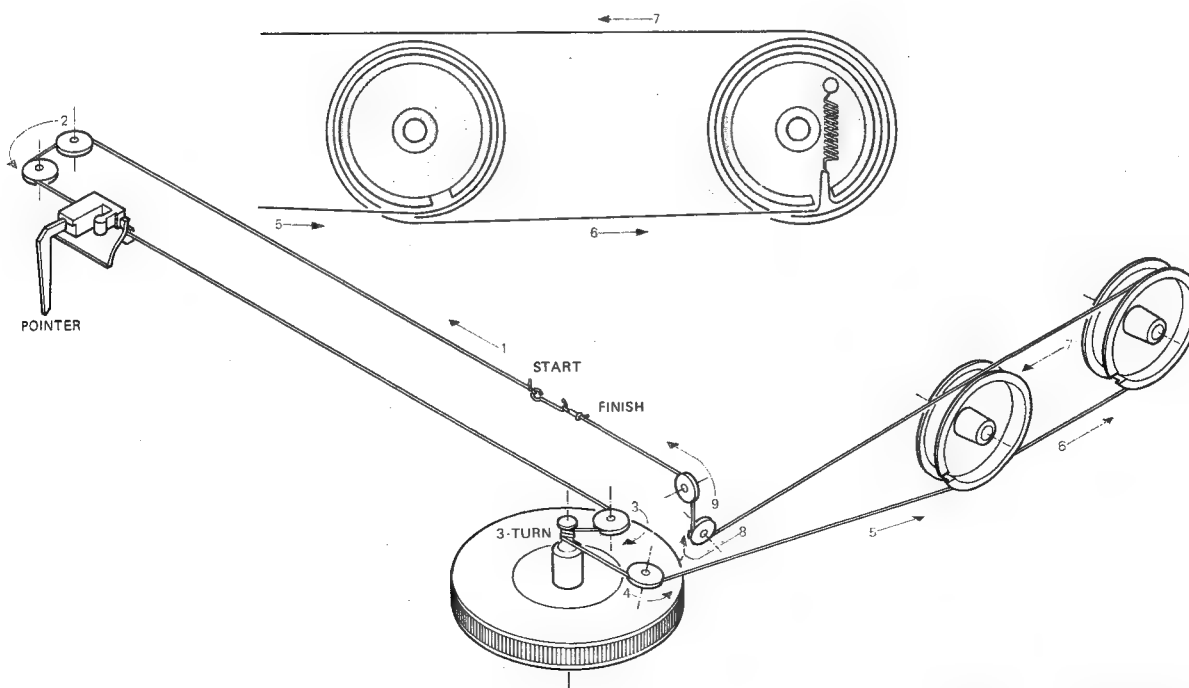


Figure 5. Dial Stringing

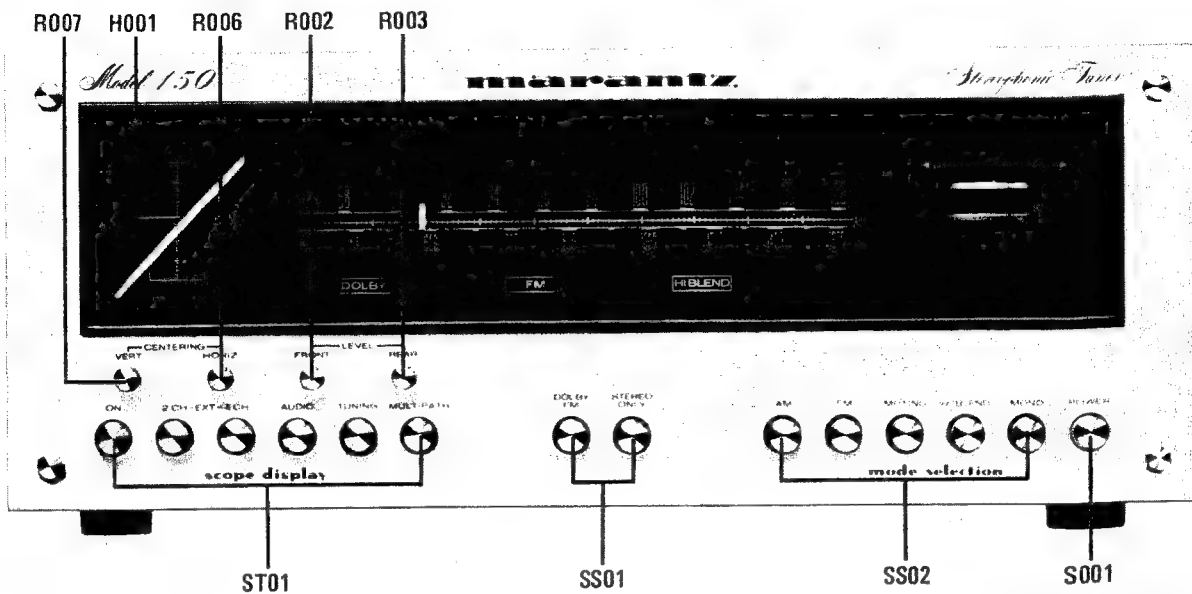


Figure 6. Front Panel Facilities Locations

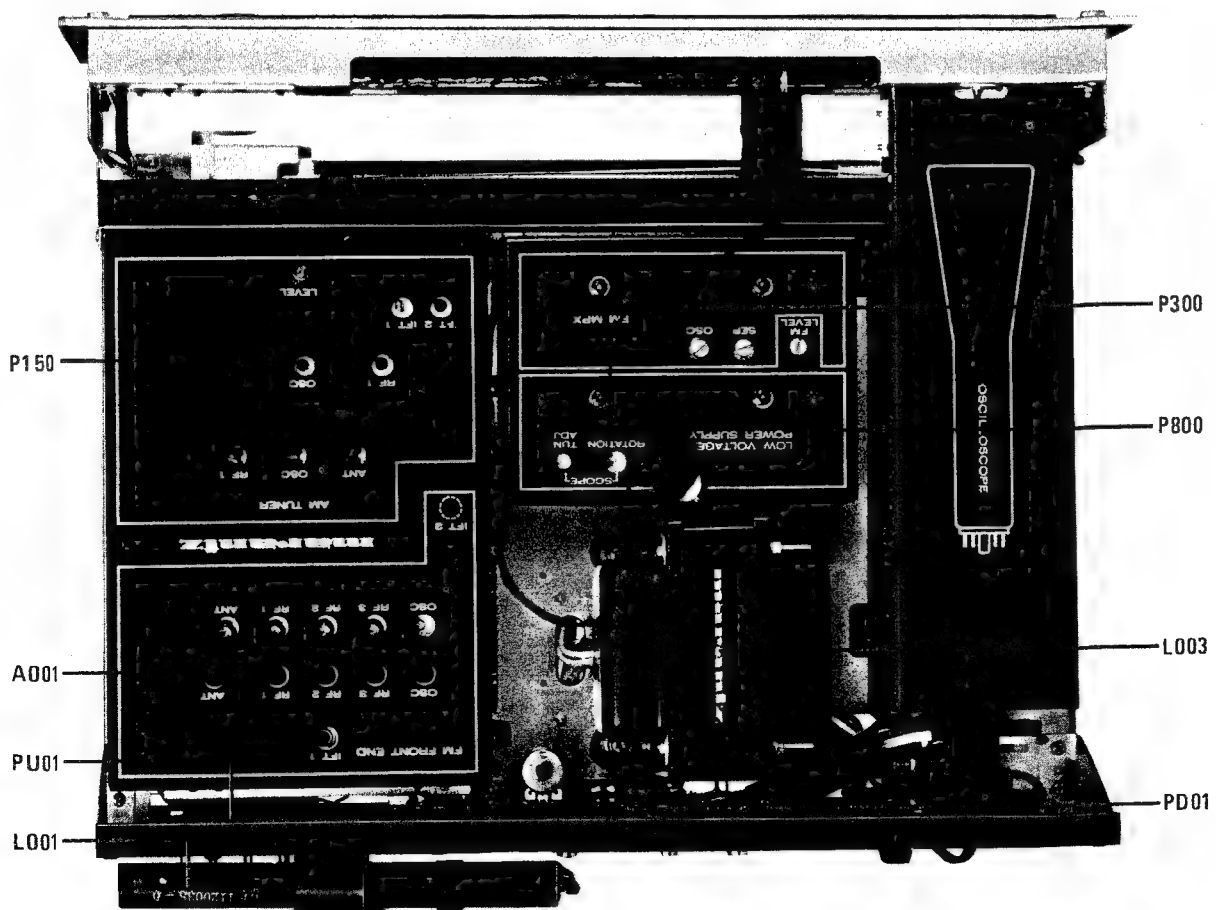


Figure 7. Main Chassis Component Locations (Top View)

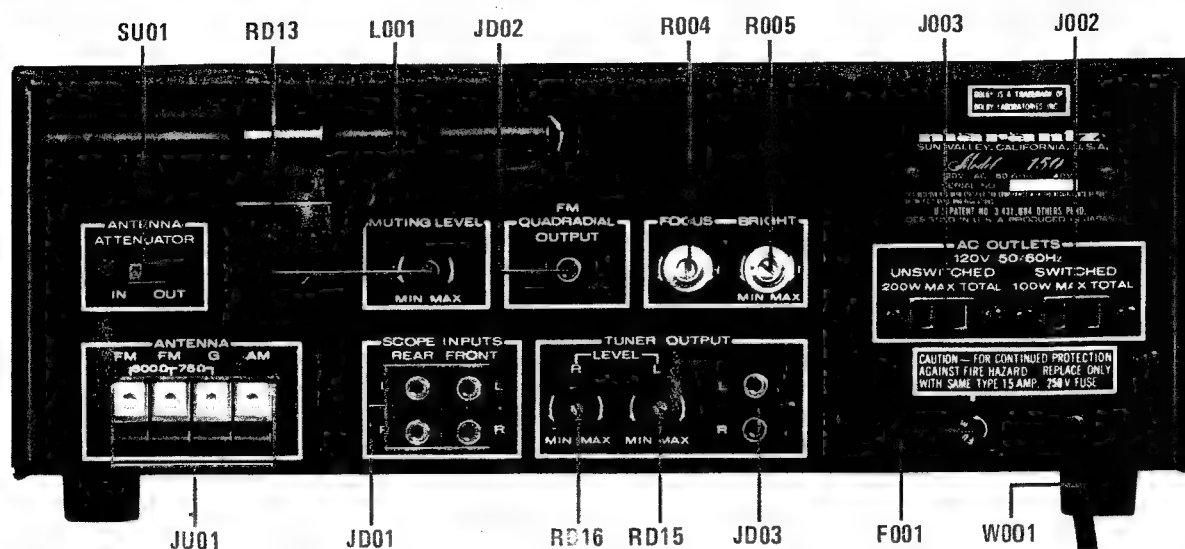


Figure 8. Rear Panel Adjustments and Facilities Locations

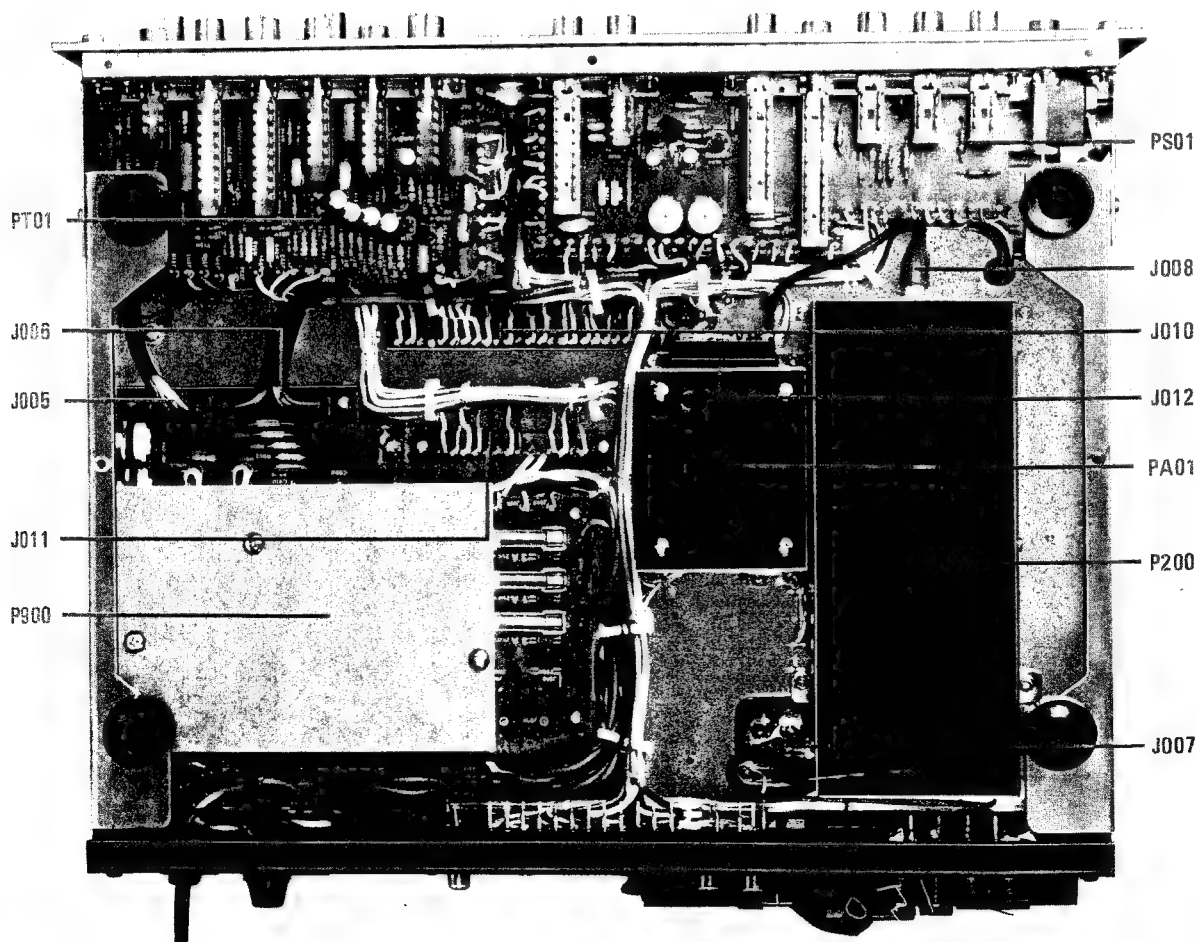


Figure 9. Main Chassis Component Locations (Bottom View)

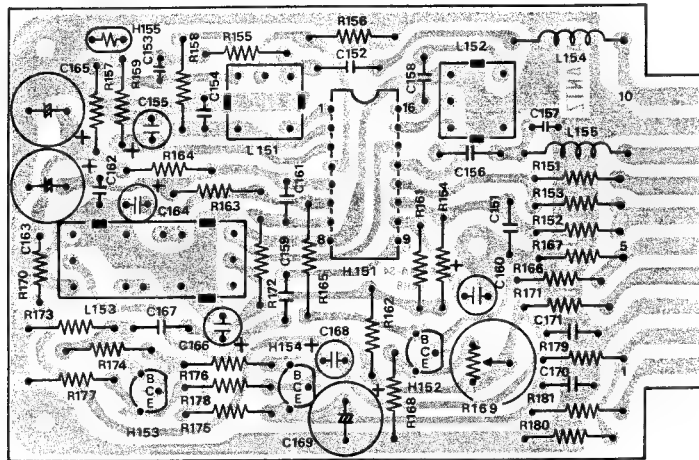


Figure 10. AM Tuner Assembly P150 Component Locations

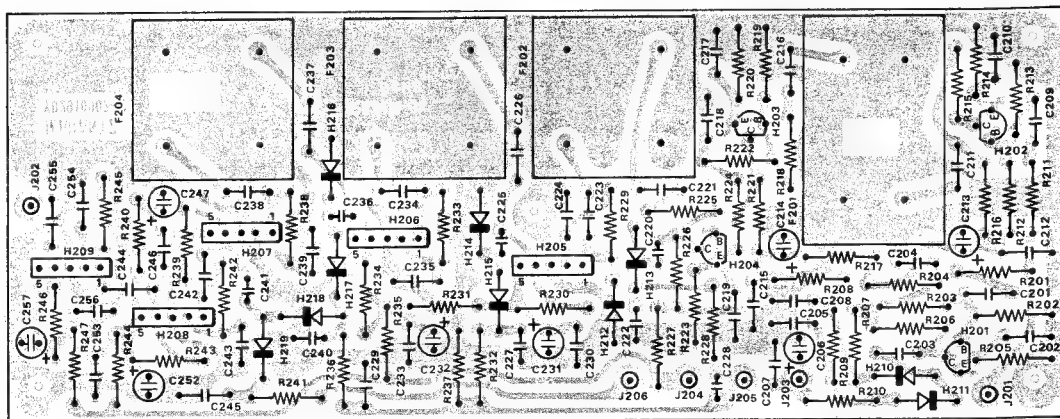


Figure 11. FM IF Amp. Assembly P200 Component Locations

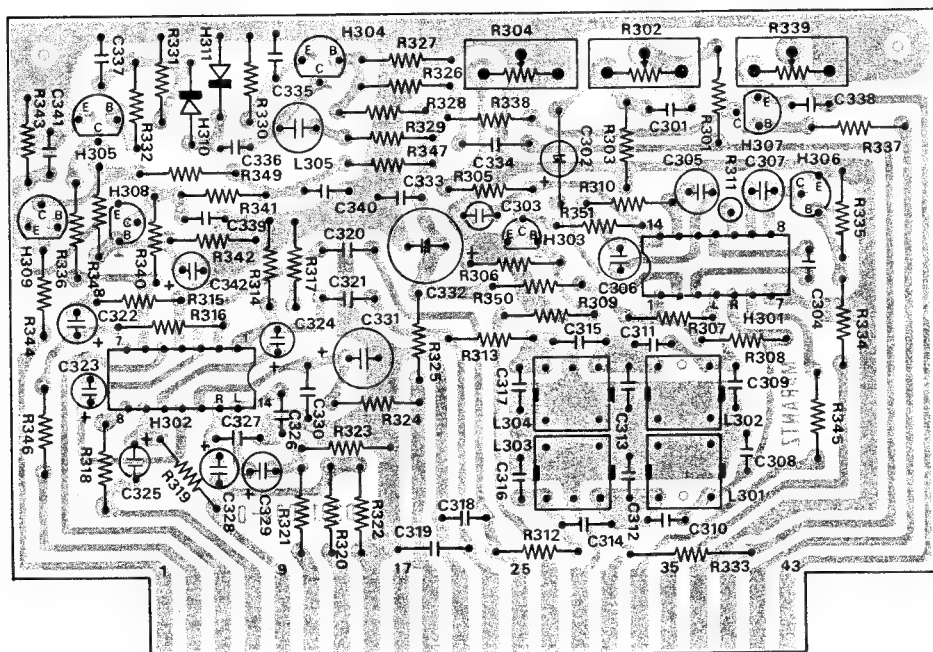


Figure 12. FM Multiplex Assembly P200 Component Locations

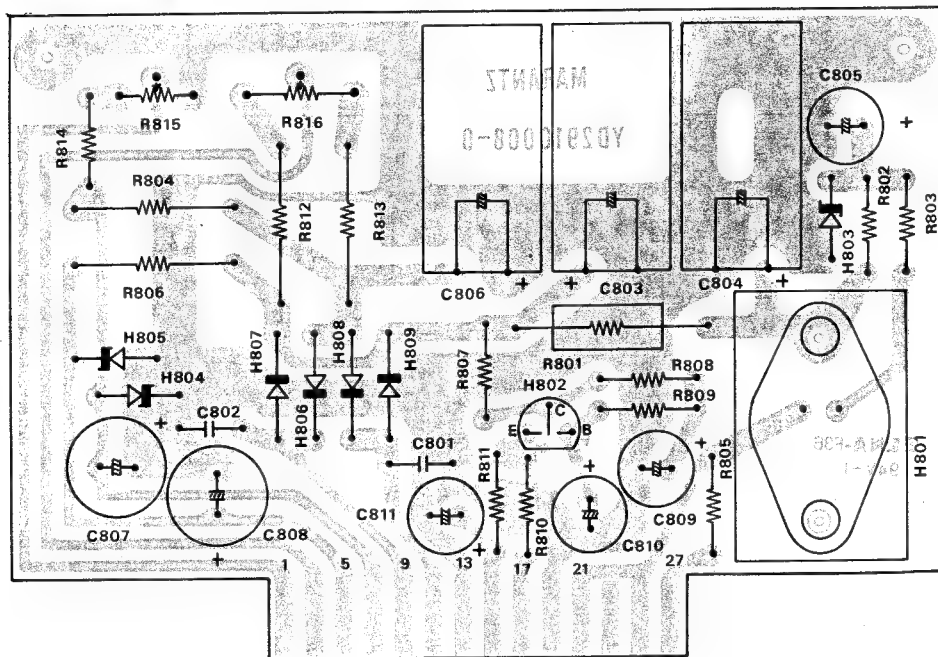


Figure 13. Power Supply Assembly P800 Component Locations

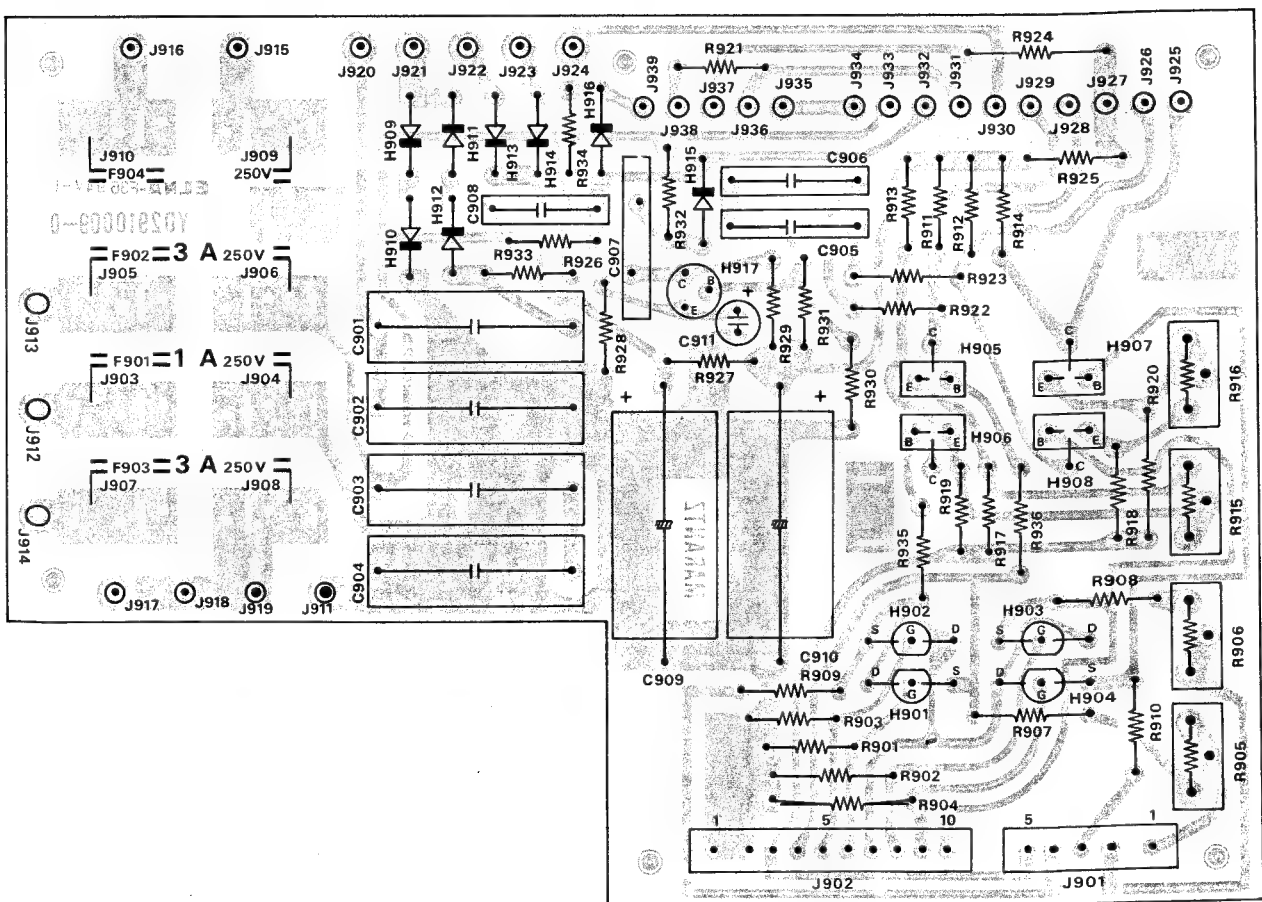


Figure 14. Scope Amp. Assembly P900 Component Locations

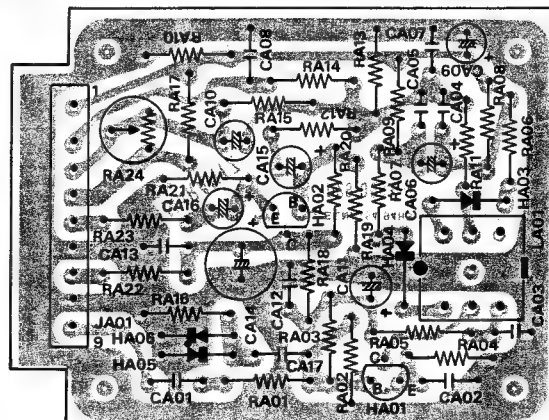


Figure 15. Ratio Detector Assembly PA01
Component Locations

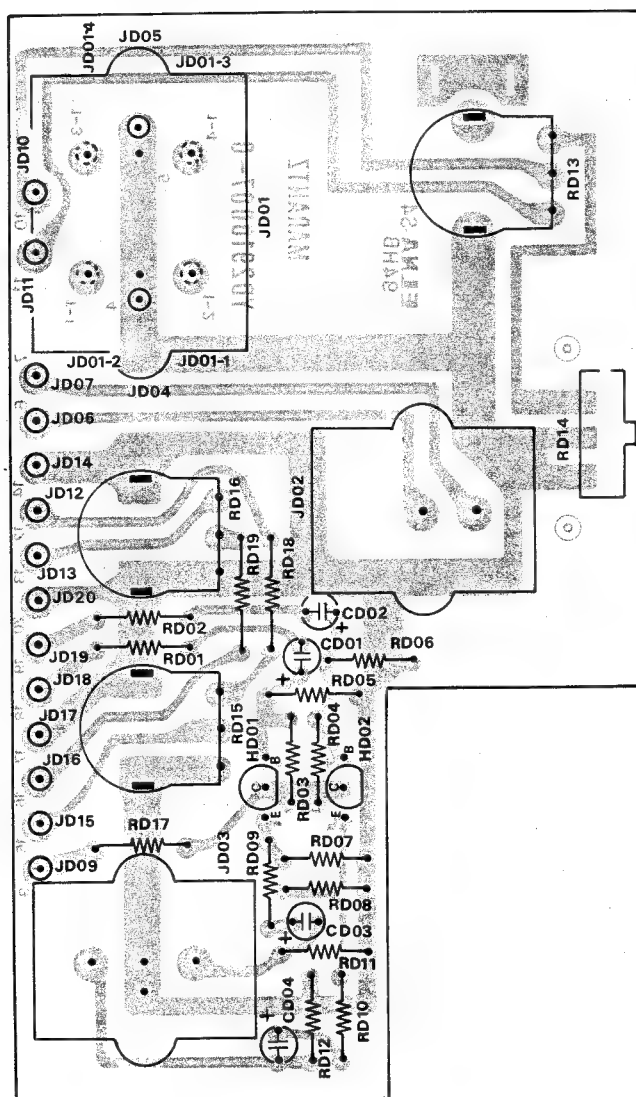


Figure 16. Pre Amp. Assembly PD01 Component Locations

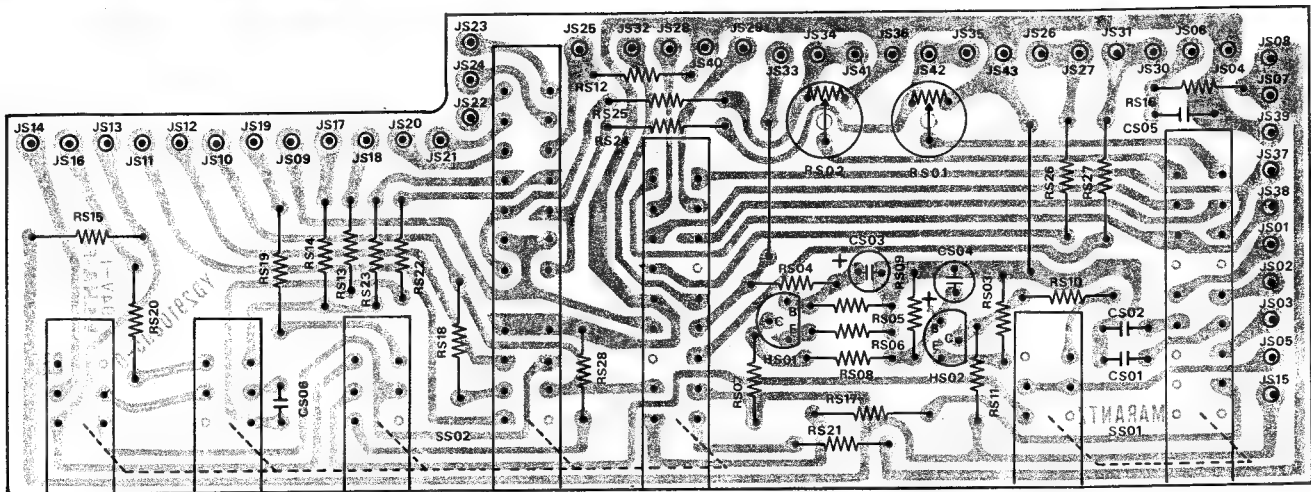


Figure 17. Selector Switch Assembly PS01 Component Locations

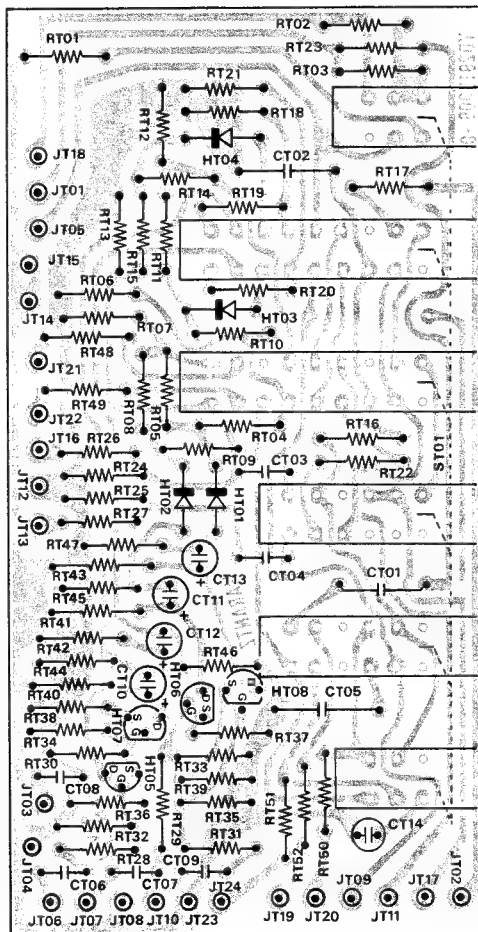


Figure 18. Display Switch Assembly PT01 Component Locations

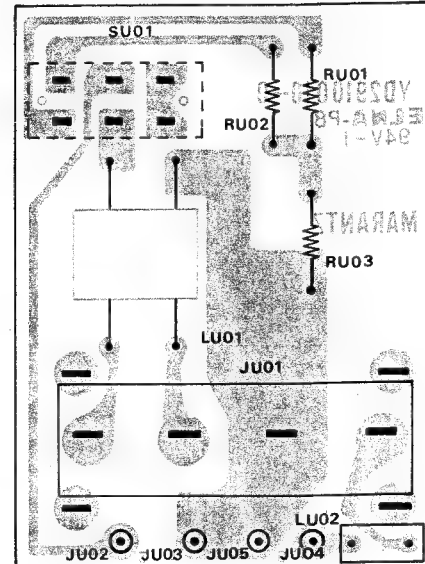


Figure 19. Antenna Att. Assembly PU01 Component Locations



Figure 20. Function Lamp Assembly PY01 Component Locations



16. PARTS LIST

REF. DESIG.	PART NO.	DESCRIPTION
A	291006340	Front Panel Assembly
0103	291006301	Front Panel
0105	285540101	Fram
0106	288715801	Window
0107	281825905	Bush x 14
0108	291005301	Cover
B	285227340	Fly Wheel Assembly
0804	257706302	Escutcheon x 2
0805	257727301	Fly Wheel
0806	285211201	Shaft
0810	53110630E	Hexagon Nut
0812	54020601E	Flat Washer
C	120200640	Hook Assembly
1104	120225801	Hook
1106	72080802A	String
D	291510341	Pointer Assembly
1204	291510301	Pointer
1205	282610301	Pointer
1206	291510302	Cover
M001	IN1008030	Lamp
E	281915943	Drum Assembly x 2
1508	281915901	Drum x 2
1509	71101689L	Spring x 2
1513	51064019A	Set Screw x 4
P100 - MISCELLANEOUS		
C001	CA0330003	Variable Cap., Ganged, AM
J007	YP0600029	Plug, RCA Pin
1603	291016002	Bracket, Front End
1604	51570306B	P. H. Tapt Screw, Front End Bracket x4 P 3 x 6 ST
1606	51100305B	B.H.M. Screw, AM Variable Cap. x 3 B 3 x 5
FM FRONT END CIRCUIT BOARD		
A001	AV0120203	FM Front End
P100-RESISTORS		
All resistors $\pm 5\%$ and $\frac{1}{4}W$		
R101	GD0510414	100K Ω
R102	GD0510514	1M Ω
R103	GD0510414	100K Ω
R104	GD0547014	47 Ω
R105	GD0510414	100K Ω
R106	GD0522114	220 Ω
R107	GD0510314	10K Ω
R108	GD0547214	4.7K Ω
R109	GD0582114	820 Ω
R110	GD0510114	100 Ω
R111	GD0510114	100 Ω
P100-CAPACITORS		
C101	CT1100001	Trimming, 1.5~10PF NPO
C102	CT1100001	Trimming, 1.5~10PF NPO
C103	CT1100001	Trimming, 1.5~10PF NPO

REF. DESIG.	PART NO.	DESCRIPTION
C104	CT1100001	Trimming, 1.5~10PF NPO
C105	CT1050003	Trimming, 3PF~8PF
C106	CA5000002	Variable, 5-Ganged
C107	DD1608201	Ceramic, 8.2PF (CH) $\pm 10\%$
C108	DD1633002	Ceramic, 33PF (CH) $\pm 10\%$
C109	DD1210006	Ceramic, 10PF (CH)
C110	DD1210006	Ceramic, 10PF (CH)
C111	DD8500350	Ceramic, 0.3PF (SL) $\pm 5\%$
C112	DD1606001	Ceramic, 6PF (CH) $\pm 10\%$
C113	DD8501550	Ceramic, 1.5PF (SL) $\pm 5\%$
C114	DD1612002	Ceramic, 12PF (LH) $\pm 10\%$
C115	DD1612003	Ceramic, 12PF (CH) $\pm 10\%$
C116	DD1647002	Ceramic, 47PF (CH)
C117	DD1615003	Ceramic, 15PF (CH) $\pm 10\%$
C118	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C119	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C120	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C121	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C122	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C123	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C124	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C125	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C126	DC1810250	Ceramic, 1000PF (Y5R)+100%, -0%, 500V. DC
C127	DC1001050	Ceramic, 1PF (SL) ± 0.25 PF, 500V. DC
C128	DC1001050	Ceramic, 1PF (SL) ± 0.25 PF, 500V. DC
C129	DC1001050	Ceramic, 1PF (SL) ± 0.25 PF, 500V. DC
C130	DC1001050	Ceramic, 1PF (SL) ± 0.25 PF, 500V. DC
P100-SEMICONDUCTORS		
H101	HF400453A	F. E. T., 3SK45
H102	HF400403A	F. E. T., 3SK40
H103	HT312152A	Transistor, 2SC1215
P100-MISCELLANEOUS		
1621	290910911	Shield, Base
1622	290910912	Shield, Plate
1623	290910913	Shield, Cover
AM TUNER CIRCUIT BOARD-P150		
P150	YD2910001	P. W. Board, AM Tuner (Print Only)
	ZZ2910001	P. W. Board Assembly for U.S.A. & Canada
	ZZ2910801	P. W. Board Assembly for Europe
P150 RESISTORS		
All resistors are $\pm 5\%$ and $\frac{1}{4}W$, unless otherwise indicated.		
R151	RC0000012	0 Ω , $\frac{1}{4}W$
R152	RC0000012	0 Ω , $\frac{1}{4}W$
R153	RT0510314	10K Ω
R154	RT0530314	30K Ω
R155	RT0533314	33K Ω

REF. DESIG.	PART NO.	DESCRIPTION
R156	RT0539314	39K Ω
R157	RC0000012	0 Ω , $\frac{1}{2}$ W
R158	RT0539214	3.9K Ω
R159	RT0543214	4.3K Ω
R161	RT0582314	82K Ω
R162	RT0533114	330 Ω
R163	RT0510214	1K Ω
R164	RT0510114	100 Ω
R165	RT0510314	10K Ω
R166	RT0547214	4.7K Ω
R167	RT0513214	1.3K Ω
R168	RT0512314	12K Ω
R169	RA0103025	Trimming, 10K Ω (B)
R170	RC0000012	Trimming, 0 Ω , $\frac{1}{2}$ W
R171	RT0533114	330 Ω
R172	RT0522214	2.2K Ω
R173	RT0582314	82K Ω
R174	RT0562414	620K Ω
R175	RT0556214	5.6K Ω
R176	RT0510114	100 Ω
R177	RT0575114	750 Ω
R178	RT0522214	2.2K Ω
R179	RT0510114	100 Ω
R180	RT0510414	100K Ω
R181	RT0510114	100 Ω
P150—CAPACITORS		
C151	DK1710301	Ceramic, 0.001 μ F \pm 20%
C152	DF1747305	Film, 0.047 μ F \pm 20%
C154	DF1710301	Film, 0.01 μ F \pm 20%
C155	EA2260169	Electroly, 22 μ F, 16V
C156	DF6545101	Film, 450PF \pm 5%
C157	DD1615001	Ceramic, 15PF \pm 10%
C158	DK1710301	Ceramic, 0.01 μ F \pm 20%
C159	DF1710305	Film, 0.01 μ F \pm 20%
C160	EA4750359	Electroly, 4.7 μ F, 35V
C161	DF1710305	Film, 0.01 μ F \pm 20%
C162	DK1840302	Ceramic, 0.04 μ F \pm 80%, -20%
C163	EA1070169	Electroly, 100 μ F, 16V
C164	EA4750359	Electroly, 4.7 μ F, 35V
C165	EA1070169	Electroly, 100 μ F, 16V
C166	DF1547201	Film, 0.0047 μ F \pm 5%
C167	DF1527305	Film, 0.027 μ F, \pm 5%
C168	EA1050509	Electroly, 1 μ F, 50V
C169	EA1070169	Electroly, 100 μ F, 16V
C170	DK1710301	Ceramic, 0.01 μ F \pm 20%
C171	DK1710301	Ceramic, 0.01 μ F \pm 20%
C172	DF1656205	Film, 0.0056 μ F \pm 10%
P150—COILS & TRANSFORMERS		
L151	LA1001019	RF Coil, AM
L152	LO1001050	OSC Coil, AM
L153	LI1028002	I.F.T.
L153	LI1028003	I.F.T.
L154	LC1332002	Choke Coil, 3.3 μ H
L155	LC1332002	Choke Coil, 3.3 μ H

REF. DESIG.	PART NO.	DESCRIPTION
H151	HC1000506	P150—SEMICONDUCTORS I. C., μ PC30C
H152	HT104942A	Transistor, 2SA494 G or Y
H153	HT313272A	Transistor, 2SC1327 S or T
H154	HT104942A	Transistor, 2SA494 G or Y
H155	HH0000212	Thermistor, 31D27
1832	51100304B	P200—MISCELLANEOUS B.H.M. Screw, P.W. Board x 5, B 3x4
1833	51100304B	B.H.M. Screw, Cover x 6, B 3x4
1835	54040302N	Spring Washer, Cover x 3
P200	YD2910002	FM IF CIRCUIT BOARD—P200 P.W. Board, FM IF (Print Only)
	ZZ2910002	P.W. Board Assembly
P200—RESISTORS All resistors are \pm 5%, $\frac{1}{4}$ W.		
R201	RT0512114	120 Ω
R202	RT0515314	15K Ω
R203	RT0533314	33K Ω
R204	RT0510114	100 Ω
R205	RT0510214	1K Ω
R206	RT0522214	2.2K Ω
R207	RT0568314	68K Ω
R208	RT0533314	33K Ω
R209	RT0522414	220K Ω
R210	RT0533314	33K Ω
R211	RT0515114	150 Ω
R212	RT0547214	4.7K Ω
R213	RT0515214	1.5K Ω
R214	RT0515214	1.5K Ω
R215	RT0515114	150 Ω
R216	RT0515214	1.5K Ω
R217	RT0510114	100 Ω
R218	RT0527114	270 Ω
R219	RT0568214	6.8K Ω
R220	RT0539114	390 Ω
R221	RT0515214	1.5K Ω
R222	RT0512214	1.2K Ω
R223	RT0510214	1K Ω
R224	RT0518214	1.8K Ω
R225	RT0527114	270 Ω
R226	RT0562114	620 Ω
R227	RT0510114	100 Ω
R228	RT0547314	47K Ω
R229	RT0510214	1K Ω
R230	RT0510214	1K Ω
R231	RT0510114	100 Ω
R232	RT0547314	47K Ω
R233	RT0510214	1K Ω
R234	RT0510214	1K Ω
R235	RT0510114	100 Ω
R236	RT0582314	82K Ω
R237	RT0582314	82K Ω
R238	RT0510214	1K Ω
R239	RT0510214	1K Ω
R240	RT0510114	100 Ω

REF. DESIG.	PART NO.	DESCRIPTION
R241	RT0582314	82K Ω
R242	RT0510214	1K Ω
R243	RT0510214	1K Ω
R244	RT0510114	100 Ω
R245	RT0510214	1K Ω
R246	RT0510214	1K Ω
R247	RT0522114	220 Ω
R248	RT0547314	47K Ω
P200—CAPACITORS		
C201	DK1710301	Ceramic, 0.01 μ F \pm 20%
C202	DK1710301	Ceramic, 0.01 μ F \pm 20%
C203	DK1710301	Ceramic, 0.01 μ F \pm 20%
C204	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C205	DK1710301	Ceramic, 0.01 μ F \pm 20%
C206	EM2240251	Electroly, 0.22 μ F, 25V
C207	DK1710301	Ceramic, 0.01 μ F \pm 20%
C208	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C209	DK1710301	Ceramic, 0.01 μ F \pm 20%
C210	DK1710301	Ceramic, 0.01 μ F \pm 20%
C211	DK1710301	Ceramic, 0.01 μ F \pm 20%
C212	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C213	EA1060169	Electroly, 10 μ F, 16V
C214	EA1060169	Electroly, 10 μ F, 16V
C215	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C216	DK1710301	Ceramic, 0.01 μ F \pm 20%
C217	DK1710301	Ceramic, 0.01 μ F \pm 20%
C218	DK1710301	Ceramic, 0.01 μ F \pm 20%
C219	DK1710301	Ceramic, 0.01 μ F \pm 20%
C220	DK1710201	Ceramic, 0.001 μ F \pm 20%
C221	DK1710301	Ceramic, 0.01 μ F \pm 20%
C222	DD1620101	Ceramic, 200PF \pm 10%
C223	DK1710301	Ceramic, 0.01 μ F \pm 20%
C224	DK1710301	Ceramic, 0.01 μ F \pm 20%
C225	DK1710201	Ceramic, 0.001 μ F \pm 20%
C226	DK1710301	Ceramic, 0.01 μ F \pm 20%
C227	DD1620101	Ceramic, 200PF \pm 10%
C229	DD1620101	Ceramic, 200PF \pm 10%
C230	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C231	EA1060169	Electroly, 10 μ F, 16V
C232	EA1060169	Electroly, 10 μ F, 16V
C233	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C234	DK1710301	Ceramic, 0.01 μ F \pm 20%
C235	DK1710301	Ceramic, 0.01 μ F \pm 20%
C236	DK1710201	Ceramic, 0.001 μ F \pm 20%
C237	DK1710301	Ceramic, 0.01 μ F \pm 20%
C238	DK1710301	Ceramic, 0.01 μ F \pm 20%
C239	DK1710301	Ceramic, 0.01 μ F \pm 20%
C240	DD1620101	Ceramic, 200PF \pm 10%
C241	DK1710201	Ceramic, 0.001 μ F \pm 20%
C242	DK1710301	Ceramic, 0.01 μ F \pm 20%
C243	DK1710301	Ceramic, 0.01 μ F \pm 20%
C244	DK1710301	Ceramic, 0.01 μ F \pm 20%
C245	DK1810402	Ceramic, 0.1 μ F +80%, -20%
C246	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C247	EA1060169	Electroly, 10 μ F, 16V
C248	DC1860150	Ceramic, 600PF, 500V
C249	DC1860150	Ceramic, 600PF, 500V
C250	DC1810050	Ceramic, 10PF, 500V
C251	DC1860150	Ceramic, 600PF, 500V
C252	EA1060169	Electroly, 10 μ F, 16V

REF. DESIG.	PART NO.	DESCRIPTION
C253	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C254	DK1710301	Ceramic, 0.01 μ F \pm 20%
C255	DK1710301	Ceramic, 0.01 μ F \pm 20%
C256	DK1840302	Ceramic, 0.04 μ F +80%, -20%
C257	EA1060169	Electroly, 10 μ F, 16V
P200—SEMICONDUCTORS		
H201	HT308291C	Transistor, 2SC829C
H202	HT308291C	Transistor, 2SC829C
H203	HT308291C	Transistor, 2SC829C
H204	HT308291C	Transistor, 2SC829C
H205	HC1000105	I. C., TA7060P
H206	HC1000105	I. C., TA7060P
H207	HC1000105	I. C., TA7060P
H208	HC1000105	I. C., TA7060P
H209	HC1000105	I. C., TA7060P
H210	HD1000105	Diode IN60
H211	HD1000105	Diode IN60
H212	HD1000105	Diode IN60
H213	HD1000105	Diode IN60
H214	HD1000105	Diode IN60
H215	HD1000105	Diode IN60
H216	HD1000105	Diode IN60
H217	HD1000105	Diode IN60
H218	HD1000105	Diode IN60
H219	HD1000105	Diode IN60
P200—FILTERS		
F201	FF3107002	L.C. Filter, 6-element, 10.7 MHz
F202	FF3107001	L.C. Filter, 4-element, 10.7 MHz
F203	FF3107001	L.C. Filter, 4-element, 10.7 MHz
F204	FF3107001	L.C. Filter, 4-element, 10.7 MHz
P200—MISCELLANEOUS		
1826	291010950	Shield K, Assembled
J208	YJ0600029	Jack
J209	YJ0600029	Jack
P300—MISCELLANEOUS		
1706	291027102	Holder, P. W. Board
1708	51100305S	B. H. M. Screw, P. W. Board x 2, B 3x5
MPX CIRCUIT BOARD—P300		
P300	YD2910004	P. W. Board, MPX (Print Only)
	ZZ2910004	P. W. Board Assembly
P300—RESISTORS		
All resistors are \pm 5% and $\frac{1}{4}$ W, unless otherwise indicated.		
R301	RT0510114	100 Ω
R302	RA0502017	Trimming, 5K Ω (B)
R303	RT0510314	10K Ω
R304	RA0502017	Trimming, 5K Ω (B)
R305	RT0516314	16K Ω
R306	RT0513314	13K Ω

REF. DESIG.	PART NO.	DESCRIPTION	REF. DESIG.	PART NO.	DESCRIPTION
R307	RT0547214	4.7K Ω	C315	DF1515205	Film, 0.0015 μ F \pm 5%
R308	RT0547214	4.7K Ω	C316	DF1522205	Film, 0.0022 μ F \pm 5%
R309	RT0522414	220K Ω	C317	DF1522205	Film, 0.0022 μ F \pm 5%
R310	RT0510214	1K Ω	C318	DF1510205	Film, 0.001 μ F \pm 5%
R311	RT0510214	1K Ω	C319	DF1510205	Film, 0.001 μ F \pm 5%
R312	RT0520314	20K Ω	C320	DF1610401	Film, 0.1 μ F \pm 10%
R313	RT0520314	20K Ω	C321	DF1610401	Film, 0.1 μ F \pm 10%
R314	RT0510514	1M Ω	C322	EA1060169	Electroly, 10 μ F, 16V
R315	RT0527114	270 Ω	C323	EV1040251	Electroly, 0.1 μ F, 25V
R316	RT0520114	200 Ω	C324	EV1040251	Electroly, 0.1 μ F, 25V
R317	RT0510514	1M Ω	C325	EA4750169	Electroly, 4.7 μ F, 16V
R318	RT0533314	33K Ω	C326	DF1668205	Film, 0.0068 μ F \pm 10%
R319	RT0530214	3K Ω	C327	DF1668205	Film, 0.0068 μ F \pm 10%
R320	RT0510214	1K Ω	C328	EV1050352	Electroly, 1 μ F, 35V
R321	RT0510214	1K Ω	C329	EV1050352	Electroly, 1 μ F, 35V
R322	RT0522414	220K Ω	C330	DK1840302	Ceramic, 0.04 μ F +80%, -20%
R323	RT0522414	220K Ω	C331	EA4760169	Electroly, 47 μ F, 16V
R324	RT0510114	100 Ω	C332	EA2270169	Electroly, 220 μ F, 16V
R325	RT0510114	100 Ω	C333	DK1840302	Ceramic, 0.04 μ F +80%, -20%
R326	RT0556214	5.6K Ω	C334	DD1620001	Ceramic, 20PF \pm 10%
R327	RT0527314	27K Ω	C335	DF1668301	Film, 0.068 μ F \pm 10%
R328	RT0510414	100K Ω	C336	DF1740301	Film, 0.04 μ F \pm 20%
R329	RT0510114	100 Ω	C337	DF1610401	Film, 0.1 μ F \pm 20%
R330	RT0510214	1K Ω	C338	EA1060169	Electroly, 10 μ F, 16V
R331	RT0547314	47K Ω	C339	DK1840302	Ceramic, 0.04 μ F +80%, -20%
R332	RT0533314	33K Ω	C340	DK1840302	Ceramic, 0.04 μ F +80%, -20%
R333	RT0533214	3.3K Ω	C341	DK1840302	Ceramic, 0.04 μ F +80%, -20%
R334	RT0522414	220K Ω	C342	EA1050509	Electroly, 1 μ F, 50V
R335	RT0522414	220K Ω			
R336	RT0522114	220 Ω			
R337	RT0533314	33K Ω			
R338	RT0510014	10 Ω			
R339	RA0103022	Trimming, 10K Ω (B)	L301	LS1029004	MPX Coil 56 mH
R340	RT0510114	100 Ω	L302	LS1029004	MPX Coil 56 mH
R341	RT0533314	33K Ω	L303	LS1029005	MPX Coil 43 mH
R342	RT0515314	15K Ω	L304	LS1029005	MPX Coil 43 mH
R343	RT0510114	100 Ω	L305	LC2105001	Choke Coil 1 mH
R344	RT0510414	100K Ω			
R345	RT0547014	47 Ω			
R346	RT0522214	2.2K Ω			
R347	RT0510114	100 Ω			
R348	RT0556214	5.6K Ω			
R349	RT0512414	120K Ω			
R350	RC0000012	0 Ω , $\frac{1}{2}$ W			
R351	RT0510114	100 Ω			
C301	DF1622205	Film, 2200PF \pm 10%			
C302	EA1060169	Electroly, 10 μ F, 16V			
C303	DF5547101	Film, 470PF \pm 5%			
C304	DF1747301	Film, 0.047 μ F \pm 20%			
C305	EQ2240501	Electroly, 0.22 μ F \pm 20%, 35V			
C306	EQ4740501	Electroly, 0.47 μ F \pm 20%, 35V			
C307	EQ2240501	Electroly, 0.22 μ F \pm 20%, 35V			
C308	DF1515205	Film, 0.0015 μ F \pm 5%			
C309	DF1515205	Film, 0.0015 μ F \pm 5%			
C310	DD1536101	Ceramic, 360PF \pm 5%			
C311	DD1536101	Ceramic, 360PF \pm 5%			
C312	DF1533205	Film, 0.0033 μ F \pm 5%			
C313	DF1533205	Film, 0.0033 μ F \pm 5%			
C314	DF1515205	Film, 0.0015 μ F \pm 5%			
C315	DF1515205	Film, 0.0015 μ F \pm 5%			
C316	DF1522205	Film, 0.0022 μ F \pm 5%			
C317	DF1522205	Film, 0.0022 μ F \pm 5%			
C318	DF1510205	Film, 0.001 μ F \pm 5%			
C319	DF1510205	Film, 0.001 μ F \pm 5%			
C320	DF1610401	Film, 0.1 μ F \pm 10%			
C321	DF1610401	Film, 0.1 μ F \pm 10%			
C322	EA1060169	Electroly, 10 μ F, 16V			
C323	EV1040251	Electroly, 0.1 μ F, 25V			
C324	EV1040251	Electroly, 0.1 μ F, 25V			
C325	EA4750169	Electroly, 4.7 μ F, 16V			
C326	DF1668205	Film, 0.0068 μ F \pm 10%			
C327	DF1668205	Film, 0.0068 μ F \pm 10%			
C328	EV1050352	Electroly, 1 μ F, 35V			
C329	EV1050352	Electroly, 1 μ F, 35V			
C330	DK1840302	Ceramic, 0.04 μ F +80%, -20%			
C331	EA4760169	Electroly, 47 μ F, 16V			
C332	EA2270169	Electroly, 220 μ F, 16V			
C333	DK1840302	Ceramic, 0.04 μ F +80%, -20%			
C334	DD1620001	Ceramic, 20PF \pm 10%			
C335	DF1668301	Film, 0.068 μ F \pm 10%			
C336	DF1740301	Film, 0.04 μ F \pm 20%			
C337	DF1610401	Film, 0.1 μ F \pm 20%			
C338	EA1060169	Electroly, 10 μ F, 16V			
C339	DK1840302	Ceramic, 0.04 μ F +80%, -20%			
C340	DK1840302	Ceramic, 0.04 μ F +80%, -20%			
C341	DK1840302	Ceramic, 0.04 μ F +80%, -20%			
C342	EA1050509	Electroly, 1 μ F, 50V			

REF. DESIG.	PART NO.	DESCRIPTION
P800—RESISTORS		
R801	GS1010105	100Ω ±10%, 5W
R802	RT0533214	3.3KΩ ±5%, ¼W
R803	RT0510014	10Ω ±5%, ¼W
R804	GJ1010202	1KΩ ±5%, 2W
R805	RC1050012	50Ω ±10%, ½W
R806	GJ1010202	1KΩ ±5%, 2W
R807	RC1010112	100Ω ±5%, ½W
R808	RT0518314	18KΩ ±5%, ¼W
R809	RT0533314	33KΩ ±5%, ¼W
R810	RC1010112	100Ω ±10%, ½W
R811	RC1010212	1KΩ ±10%, ½W
R812	GJ0515202	1.5KΩ ±5%, 2W
R813	GJ0515202	1.5KΩ ±5%, 2W
R814	RT0515214	1.5KΩ ±5%, ¼W
R815	RA0103022	Trimming, 10KΩ (B)
R816	RA0202014	Trimming, 2KΩ (B), 0.75W
P800—CAPACITORS		
C801	DK1810351	Ceramic, 0.01μF +100%, -0%, 500V
C802	DK1810351	Ceramic, 0.01μF +100%, -0%, 500V
C802	DK1810351	Ceramic, 0.01μF +100%, -0%, 500V
C803	EA3370509	Electroly, 330μF, 50V
C804	EA3370509	Electroly, 330μF, 50V
C805	EA1070169	Electroly, 100μF, 16V
C806	EA3370509	Electroly, 330μF, 50V
C807	EA3370169	Electroly, 330μF, 16V
C808	EA3370169	Electroly, 330μF, 16V
C809	EA4760509	Electroly, 47μF, 50V
C810	EA4760509	Electroly, 47μF, 50V
C811	EA4760509	Electroly, 47μF, 50V
P800—SEMICONDUCTORS		
H801	HT403154A	Transistor, 2SD315 C, D, E, F
H802	HT313182Q	Transistor, 2SC1318 Q or R
H803	HD3003209	Diode, CZ142
H804	HD3002109	Diode, BZ140
H805	HD3002109	Diode, BZ140
H806	HD2000501	Diode, W06B
H807	HD2000501	Diode, W06B
H808	HD2000501	Diode, W06B
H809	HD2000501	Diode, W06B
P800—MISCELLANEOUS		
1710	273026702	Heat—Sink
1711	51100310B	B. H. M. Screw, Transistor x 2 B 3x10
1712	54050300R	T. L. Washer OR
1713	53110303E	Hexagon Nut x 2
P900—MISCELLANEOUS		
1812	281811806	Spacer
1813	291016008	Bracket x 3
1815	290426703	Heat - Singk x 2
1816	54040302N	Spring washer x 4
1817	50020305B	R.H. Screw x 4

REF. DESIG.	PART NO.	DESCRIPTION
P900	YD2910009 ZZ2910009	SCOPE AMP. CIRCUIT BOARD—P900 P. W. Board, Scope Amp. (Print Only) P. W. Board Assembly
P900—RESISTORS		
R901	RT0522414	220KΩ ±5%, ¼W
R902	RT0522414	220KΩ ±5%, ¼W
R903	RT0522414	220KΩ ±5%, ¼W
R904	RT0522414	220KΩ ±5%, ¼W
R905	RA0502017	Trimming, 5KΩ (B)
R906	RA0502017	Trimming, 5KΩ (B)
R907	RT0547214	4.7KΩ ±5%, ¼W
R908	RT0547214	4.7KΩ ±5%, ¼W
R909	RT0568214	6.8KΩ ±5%, ¼W
R910	RT0568214	6.8KΩ ±5%, ¼W
R911	GU0568312	68KΩ ±5%, ½W
R912	GU0568312	68KΩ ±5%, ½W
R913	GU0568312	68KΩ ±5%, ½W
R914	GU0568312	68KΩ ±5%, ½W
R915	RA0202013	Trimming, 2KΩ (B)
R916	RA0102020	Trimming, 1KΩ (B)
R917	RT0515314	15KΩ ±5%, ¼W
R918	RT0515314	15KΩ ±5%, ¼W
R919	RT0515314	15KΩ ±5%, ¼W
R920	RT0515314	15KΩ ±5%, ¼W
R921	RT0547314	47KΩ ±5%, ¼W
R922	RT0522414	220KΩ ±5%, ¼W
R923	RT0522414	220KΩ ±5%, ¼W
R924	GT0568401	680KΩ ±5%, 1W
R925	GU0568312	68KΩ ±5%, ½W
R926	RC1010412	100KΩ ±5%, ½W
R927	RC1022212	2.2KΩ ±10%, ¼W
R928	RT0518214	1.8KΩ ±5%, ¼W
R929	GU0582312	82KΩ ±5%, ½W
R930	RT0522314	22KΩ ±5%, ¼W
R931	RT0515514	1.5MΩ ±5%, ¼W
R932	RT0510514	1MΩ ±5%, ¼W
R933	RT0515514	1.5MΩ ±5%, ¼W
R934	RT0547214	4.7KΩ ±5%, ¼W
R935	RC0000012	0Ω, ½W
R936	RC0000012	0Ω, ½W
P900—CAPACITORS		
C901	DF1747450	Film, 0.47μF ±20%, 630V
C902	DF1747450	Film, 0.47μF ±20%, 630V
C903	DF1747450	Film, 0.47μF ±20%, 630V
C904	DF1747450	Film, 0.47μF ±20%, 630V
C905	DF1710452	Film, 0.1μF ±20%, 200V
C906	DF1710452	Film, 0.1μF ±20%, 200V
C907	DK1810383	Ceramic, 0.01μF, 1.4KV
C908	DF1747352	Film, 0.047μF ±20%, 200V
C909	ED2262501	Electroly, 22μF, 250V
C910	ED2262501	Electroly, 22μF, 250V
C911	EA2260169	Electroly, 22μF, 16V
P900—SEMICONDUCTORS		
H901	HF200300B	F.E.T., 2SK30A
H902	HF200300B	F.E.T., 2SK30A
H903	HF200300B	F.E.T., 2SK30A
H904	HF200300B	F.E.T., 2SK30A

REF. DESIG.	PART NO.	DESCRIPTION
H905	HT315071M	Transistor, 2SC1507 MorL
H906	HT315071M	Transistor, 2SC1507 MorL
H907	HT315071M	Transistor, 2SC1507 MorL
H908	HT315071M	Transistor, 2SC1507 MorL
H909	HD2000908	Diode, SH-1A
H910	HD2000908	Diode, SH-1A
H911	HD2000908	Diode, SH-1A
H912	HD2000908	Diode, SH-1A
H913	HD2000908	Diode, SH-1A
H914	HD2000908	Diode, SH-1A
H915	HD2000413	Diode, SIB-01-02
H916	HD2000413	Diode, SIB-01-02
H917	HT309952A	Transistor, 2SC995 F, H
P900—MISCELLANEOUS		
F901	FS1010008	Fuse, 1A (UL), For U.S.A.
F902	FS1030006	Fuse, 3A (UL), For U.S.A.
F903	FS1030006	Fuse, 3A (UL), For U.S.A.
J901	YP1000121	Plug, 5P
J902	YP1000117	Plug, 10P
J903		
}	YJ0800017	Socket, For U.S.A.
J908		
J911		
}	YP1000113	Plug
J914		
J917		
}	YP1000113	Plug
J939		
RATIO DETECTOR CIRCUIT BOARD		
-PA01		
PA01	YD2910003	P. W. Board, Ratio Detector (Print Only)
	ZZ2910003	P. W. Board Assembly
PA01-RESISTORS		
All resistors are $\pm 5\%$ and $\frac{1}{4}W$, unless otherwise indicated.		
RA01	RT0515114	150 Ω
RA02	RT0568214	6.8K Ω
RA03	RT0515314	15K Ω
RA04	RT0510214	1K Ω
RA05	RT0522114	220 Ω
RA06	RT0582114	820 Ω
RA07	RT0582114	820 Ω
RA08	RT0510314	10K Ω
RA09	RT0582214	8.2K Ω
RA10	RT0510414	100K Ω
RA11	RT0510114	100 Ω
RA12	RT0556214	5.6K Ω
RA13	RT0510414	100K Ω
RA14	RT0530314	30K Ω
RA15	RT0522414	220K Ω
RA16	RT0510414	100K Ω
RA17	RT0522414	220K Ω
RA18	RT0510114	100 Ω
RA19	RT0510414	100K Ω
RA20	RT0518414	180K Ω
RA21	RT0522214	2.2K Ω

REF. DESIG.	PART NO.	DESCRIPTION
RA22	RT0510114	100 Ω
RA23	RT0510114	100 Ω
RA24	RA0254001	Trimming, 250K Ω (B)
PA01—CAPACITORS		
CA01	DK1710301	Ceramic, 0.01 μF $\pm 20\%$
CA02	DK1710301	Ceramic, 0.01 μF $\pm 20\%$
CA03	DK1840302	Ceramic, 0.04 μF $+100\%, -0\%$
CA04	DD1620101	Ceramic, 200PF $\pm 10\%$
CA05	DD1620101	Ceramic, 200PF $\pm 10\%$
CA06	EA1060169	Electroly, 10 μF , 16V
CA07	DD1610101	Ceramic, 100PF $\pm 10\%$
CA08	DK1840302	Ceramic, 0.04 μF $+100\%, -0\%$
CA09	EA1060169	Electroly, 10 μF , 16V
CA10	EQ4740501	Electroly, 0.47 μF $\pm 20\%$, 50V
CA11	EA1060169	Electroly, 10 μF , 16V
CA12	DK1840302	Ceramic, 0.04 μF , $+100\%, -0\%$
CA13	DK1840302	Ceramic, 0.04 μF $+100\%, -0\%$
CA14	EA1070169	Electroly, 100 μF , 16V
CA15	EA1050509	Electroly, 1 μF , 50V
CA16	EA1060169	Electroly, 10 μF , 16V
CA17	DK1710301	Ceramic, 0.01 μF $\pm 20\%$
PA01—SEMICONDUCTORS		
HA01	HT308291C	Transistor, 2SC829C
HA02	HT306441B	Transistor, 2SC644S
HA03	HD1000302	Diode, 20A90M
HA04	HD1000302	Diode, 20A90M
HA05	HD2001105	Diode, 1S1555
HA06	HD2001105	Diode, 1S1555
PA01—MISCELLANEOUS		
JA01	YP0600027	Plug, 929
LA01	LI1401623	I. F. T., FM
SELECTOR SWITCH CIRCUIT BOARD -PS01		
PS01	YD2910005	P. W. Board, Selector Switch(Print Only)
PS01—RESISTORS		
RS01	RA0104018	Trimming, 100K Ω (B)
RS02	RA0104018	Trimming, 100K Ω (B)
RS03	RT0510114	100 Ω $\pm 5\%$, $\frac{1}{4}W$
RS04	RT0512414	120K Ω $\pm 5\%$, $\frac{1}{4}W$
RS05	RT0515314	15K Ω $\pm 5\%$, $\frac{1}{4}W$
RS06	RT0510214	1K Ω $\pm 5\%$, $\frac{1}{4}W$
RS07	RT0522314	22K Ω $\pm 5\%$, $\frac{1}{4}W$
RS08	RT0533314	33K Ω $\pm 5\%$, $\frac{1}{4}W$
RS09	RT0547214	4.7K Ω $\pm 5\%$, $\frac{1}{4}W$
RS10	RT0510114	100 Ω $\pm 5\%$, $\frac{1}{4}W$
RS11	RT0556214	5.6K Ω $\pm 5\%$, $\frac{1}{4}W$
RS13	RT0556114	560 Ω $\pm 5\%$, $\frac{1}{4}W$
RS14	RT0556114	560 Ω $\pm 5\%$, $\frac{1}{4}W$
RS15	RT0510214	1K Ω $\pm 5\%$, $\frac{1}{4}W$
RS16	RT0510114	100 Ω $\pm 5\%$, $\frac{1}{4}W$
RS17	GJ0503301	33 Ω $\pm 5\%$, 1W

REF. DESIG.	PART NO.	DESCRIPTION
RS18	GJ0503301	33Ω ±5%, 1W
RS19	GJ0503301	33Ω ±5%, 1W
RS20	GJ0503301	33Ω ±5%, 1W
RS21	RC0000012	0Ω, ½W
RS22	RC0000012	0Ω, ½W
RS23	RC0000012	0Ω, ½W
RS24	RC0000012	0Ω, ½W
RS25	RC0000012	0Ω, ½W
RS26	RC0000012	0Ω, ½W
RS27	RC0000012	0Ω, ½W
RS28	RC0000012	0Ω, ½W
RS29	RT0524214	2.4KΩ ±5%, ½W
PS01—CAPACITORS		
CS01	DF1522205	Film, 2200PF ± 5%, For U.S.A.
CS02	DF1522205	Film, 2200PF ± 5%, For U.S.A.
CS03	EA1050509	Electroly, 1μF, 50V
CS04	EA1050509	Electroly, 1μF, 50V
CS05	DK1710301	Ceramic, 1μF, 50V
CS06	DF1622301	Film, 0.022μF ±10%
CS07	EA1060169	Electroly, 10μF, 16V
PS01—MISCELLANEOUS		
HS01	HT308281D	Transistor, 2SC828S
HS02	HT308281D	Transistor, 2SC828S
SS01	SP0602008	Pushswitch
SS02	SP0805002	Pushswitch
JS01	YP1000113	Plug
JS43		
DISPLAY SWITCH CIRCUIT BOARD		
—PT01		
PT01	YD2910006	P.W. Board, Display Switch (Print Only)
	ZZ2910006	P.W. Board Assembly
PT01—RESISTORS		
All resistors are ±5% and ½W, unless otherwise indicated.		
RT51	RT0530414	300KΩ
RT52	RC0000012	0Ω, ½W
RT53	RT0530314	30KΩ
RT54	RT0539414	390KΩ
RT01	RT0522314	22KΩ
RT02	RC1010112	100Ω ±10%, ½W
RT03	GF0533012	33Ω ±10%, ½W
RT04	RT0556214	5.6KΩ
RT05	RT0556214	5.6KΩ
RT06	RT0556214	5.6KΩ
RT07	RT0556214	5.6KΩ
RT08	RT0556214	5.6KΩ
RT09	RT0556214	5.6KΩ
RT10	RT0556214	5.6KΩ
RT11	RT0556214	5.6KΩ
RT12	RT0556214	5.6KΩ
RT13	RT0556214	5.6KΩ
RT14	RT0556214	5.6KΩ

REF. DESIG.	PART NO.	DESCRIPTION
RT15	RT0556214	5.6KΩ
RT16	RT0527414	270KΩ
RT17	RT0510314	10KΩ
RT18	RT0512414	120KΩ
RT19	RT0527414	270KΩ
RT20	RT0527414	270KΩ
RT21	RT0512414	120KΩ
RT22	RT0527414	270KΩ
RT23	RT0518414	180KΩ
RT24	RT0582314	82KΩ
RT25	RT0582314	82KΩ
RT26	RT0510414	100KΩ
RT27	RT0510414	100KΩ
RT28	RT0510414	100KΩ
RT29	RT0510414	100KΩ
RT30	RT0510414	100KΩ
RT31	RT0510414	100KΩ
RT32	RT0510514	1MΩ
RT33	RT0510514	1MΩ
RT34	RT0510514	1MΩ
RT35	RT0510514	1MΩ
RT36	RT0515114	150Ω
RT37	RT0515114	150Ω
RT38	RT0515114	150Ω
RT39	RT0515114	150Ω
RT40	RT0556214	5.6KΩ
RT41	RT0556214	5.6KΩ
RT42	RT0556214	5.6KΩ
RT43	RT0556214	5.6KΩ
RT44	RT0556214	5.6KΩ
RT45	RT0556214	5.6KΩ
RT46	RT0556214	5.6KΩ
RT47	RT0556214	5.6KΩ
RT48	RC0000012	0Ω, ½W
RT49	RC0000012	0Ω, ½W
RT50	RC0000012	0Ω, ½W
PT01—CAPACITORS		
CT01	DF1610405	Film, 0.1μF ±10%, 50V
CT02	DF1722405	Film, 0.22μF ±20%, 50V
CT03	DF1747305	Film, 0.047μF ±20%, 50V
CT04	DF1747305	Film, 0.047μF ±20%, 50V
CT05	DF1733405	Film, 0.33μF ±20%, 50V
CT06	DF1747305	Film, 0.047μF ±20%, 50V
CT07	DF1747305	Film, 0.047μF ±20%, 50V
CT08	DF1747305	Film, 0.047μF ±20%, 50V
CT09	DF1747305	Film, 0.047μF ±20%, 50V
CT10	EA1060359	Electroly, 10μF, 35V
CT11	EA1060359	Electroly, 10μF, 35V
CT12	EA1060359	Electroly, 10μF, 35V
CT13	EA1060359	Electroly, 10μF, 35V
CT14	EQ2240501	Electroly, 0.22μF, 50V
PT01—SEMICONDUCTORS		
HT01	HD1000302	Diode, 20A90M
HT02	HD1000302	Diode, 20A90M
HT03	HD1000302	Diode, 20A90M
HT04	HD1000302	Diode, 20A90M
HT05	HF200301C	F. E. T., 2SK30A—Y
HT06	HF200301C	F. E. T., 2SK30A—Y

REF. DESIG.	PART NO.	DESCRIPTION	REF. DESIG.	PART NO.	DESCRIPTION
HT07 HT08	HF200301C HF200301C	F. E. T., 2SK30A-Y F. E. T., 2SK30A-Y	MY05 MY06	IN1006301 IN1012011	HIBLEND STEREO
JT01 JT24 ST01	YP1000113 SP0606001	PT01-MISCELLANEOUS Plug Pushswitch	JY01 JY09	YP1000113	PY01-PLUGS Plug
0602 0607 0613 0614 0615 0618 0619 0620 0633 0634	288716050 291026250 128326201 51100306A 51103019B 288416003 288416004 51100406A 51042606S 53112603E	GENERAL MISCELLANEOUS Bracket K, Front Mounting Pulley K Pulley, Small B. H. M. Screw, Pulley K x 2 B 3x6 B. H. M. Screw, Pulley K x 2 B 3x6 Bracket, Right-hand Bracket, Left-hand B. H. M. Screw, Front Plate x 5 B4x6 F. H. M. Screw, Dial Reflector x 4 F2.6x6 Hexagon Nut, Dial Reflector (lower) x 2	0629 0630	288427101 51570306B	PZ01-MISCELLANEOUS Holder, Dial Lamp P. W. Board P. H. Tapt Screw, Dial Lamp P.W. Board x 3 P 3x6 ST
0635 0702 0706 0707 0708	54022601E 51470306A 257710602 141511801 51040306A	Flat Washer, P, Dial Reflector (lower) x 2 B. H. M. Screw x 2 Bearing, Delrin Spacer, Mylar F. H. M. Screw, Bearing Fixing : 2 F 3x6	PZ01	YD2884003 ZZ2884003	DIAL LAMP BOARD-PZ01 P. W. Board, Dial Lamp (Print Only) P.W. Board Assembly
R006 R007	RK0103021 RK0103021	Variable Resist. 10KΩ(B) H. Center Variable Resist. 10KΩ(B) V. Center	MZ01 MZ02	IN1008007	PZ01-MISCELLANEOUS Lamp, Dial Illumination
J005	YJ0600026	Socket, 5P	JZ01 JZ10	YJ0800017	Socket
0903 0908 0909 0910 1002 1008 1015 1016 0626 0631	281810650 51640412D 54040402N 53110403E 288405150 288726252 51102604A 281810107 288427401 51100306A	Bearing K, Upper, Fly-wheel Set Screw C. P., Fly-wheel Spring Washer, Fly-wheel Hexagon Nut, Fly-wheel Guide K Pulley K B. H. M. Screw, Pulley K x 2 B2.6x4 Support, Mounted on Pulley K Reflector, Dial B. H. M. Screw x 2 B 3x6	JZ11 JZ14	YP1000113	Plug
0632	51480306A	B. H. M. Screw F. x 2	0402 0423 0432 0501 0502 0503 0506 0512 0513 0515 G001 F001 J001 J002 J003 W001 L001	291016001 51100306S 53228059E 289611801 51100308S 53110303A 51100306S 51100306S 51100306S 51100305S 145525903 BF1040002 FS1015005 YJ0800012 YJ0400048 YJ0400048 YC0240010 LF1120038	GENERAL MISCELLANEOUS Bracket, Terminal Board, For U.S.A. B. H. M. Screw x 3 B 3x6 Nut, Focus & Bright VR x 2 Spacer, AC Outlet x 2 B. H. M. Screw, AC Outlet x 4 B 3x8 Hexagon Nut, AC Outlet x 4 B. H. M. Screw, PD01 Mounting x 4 B 3x6 B. H. M. Screw, JU01 Mounting x 2 B 3x6 B. H. M. Screw, SU01 Mounting x 2 B 3x5 Bush, Power Cord Antenna x 2 Printed Compo., For U.S.A. Fuse, 1.5A (UL), For U.S.A. Socket, Fuse Holder, For U.S.A. Socket, AC Outlet Socket, AC Outlet AC Cord Antenna Coil, AM
0627 0628	288427102 51570306B	PY01-MISCELLANEOUS Holder, Function Lamp P. W. Board P. H. M. Screw, Function Lamp P.W. Board x 2 P 3x6 ST	1405 1410 1412 1416 1417 1418 1419 1420	257816052 281927103 318827102 51100310S 53110303E 51100308S 53110303E 54050300R	Bracket K, Antenna Holder Holder, Rubber B. H. M. Screw x 2 B 3x10 Hexagon Nut x 2 B. H. M. Screw x 2 B 3x8 Hexagon Nut x 2 T. L. Washer OR x 2
PY01	YD2910011 ZZ2910011	FUNCTION LAMP BOARD-PY01 P. W. Board, Function Lamp(Print Only) P.W. Board Assembly			
MY01 MY02 MY03 MY04	IN1006301 IN1006301 IN1006301 IN1006301	PY01-LAMPS DOLBY AM FM MUTING			

REF. DESIG.	PART NO.	DESCRIPTION	REF. DESIG.	PART NO.	DESCRIPTION
PU01	YD2910010 ZZ2910010	ANTENNA ATT. BOARD—PU01 P. W. Board, Antenna Att. (Print Only) P. W. Board Assembly	JD01	YT0204007	Terminal, RCA 4P
			JD02	YT0201010	Terminal, RCA 1P
			JD03	YT0202010	Terminal, RCA 2P
			JD04		
			?	YP1000113	Plug
			JD20		
RU01	RT0568014	PU01—MISCELLANEOUS Resistor, 68 Ω \pm 5%, $\frac{1}{4}$ W	0505	291016005	Bracket, Soldered on P. W. Board
RU02	RT0568014	Resistor, 68 Ω \pm 5%, $\frac{1}{4}$ W	0508	291016004	Bracket, Volume Mounting
RU03	RT0508214	Resistor, 8.2 Ω \pm 5%, $\frac{1}{4}$ W	0509	51100306S	B. H. M. Screw, P. W. Board Mounting x 2, B 3x6
LU01	LB3007526	Balun Coil			
LU02	LC1104001	Choke Coil, 100 μ H			
SU01	SS0202038	Slide Switch, Antenna Att.			
JU01	YT0304007	Terminal, FM/AM Antenna	R004	RK0504009	GENERAL MISCELLANEOUS Variable Resist., 500K Ω (B), Focus
JU02	YP1000113	Plug	R005	RK0104013	Variable Resist., 100K Ω (B), Bright
JU03	YP1000113	Plug	R001	RC1022512	Resistor, 2.2M Ω \pm 10%, $\frac{1}{2}$ W, For U.S.A
JU04	YP1000113	Plug			
JU05	YP1000113	Plug	2015	62030039	Lug
0511	291016003	Bracket	0726	288410701	Sheet, Tracing Paper (White)
PD01	YD2910007 ZZ2910007	PRE AMP. CIRCUIT BOARD—PD01 P. W. Board, Pre Amp. (Print Only) P. W. Board, Assembly	H001	VB0034001	Picture Tube, Scope 3.5"
			L002	LD0004001	Deflection Coil
			1311	288705602	Buffer, Rubber
			1312	288710906	Shield, Parmalloy
			1314	288727101	Holder
			1315	288705601	Buffer, Sticked to Holder Inside x 4
			1302	288705302	Cover, Black
			1303	288730203	Dial
			1304	288710401	Retainer, Lamp
			1305	288705303	Cover, Paper
			1307	511026068	B.H.M. Screw, Lamp x 2 B 2.6x6
			M002	IN1005003	Lamp, Scope Illumination
			S001	SP0101016	Pushswitch (UL), For U.S.A.
RD01	RT0539114	PD01—RESISTORS 390 Ω \pm 5%, $\frac{1}{4}$ W	0616	288210901	Shield x 2
RD02	RT0539114	390 Ω \pm 5%, $\frac{1}{4}$ W	1612	291010450	Retainer K, AM Connector
RD03	RT0510514	1M Ω \pm 5%, $\frac{1}{4}$ W	1616	51100308B	B.H.M. Screw, AM Connector x 2 B 3x8
RD04	RT0510514	1M Ω \pm 5%, $\frac{1}{4}$ W			
RD05	RT0510514	1M Ω \pm 5%, $\frac{1}{4}$ W	J009	YJ0700012	Socket, 10P
RD06	RT0510514	1M Ω \pm 5%, $\frac{1}{4}$ W	J004	YJ0500018	Socket, CRT
RD07	RT0510314	10K Ω \pm 5%, $\frac{1}{4}$ W			
RD08	RT0510314	10K Ω \pm 5%, $\frac{1}{4}$ W			
RD09	RT0515114	150 Ω \pm 5%, $\frac{1}{4}$ W	1731	51060212B	P.H.M. Screw, CRT Socket x 3, P2x2
RD10	RT0515114	150 Ω \pm 5%, $\frac{1}{4}$ W	1732	53110203E	Hexagon Nut, CRT Socket
RD11	RT0510414	100K Ω \pm 5%, $\frac{1}{4}$ W			
RD12	RT0510414	100K Ω \pm 5%, $\frac{1}{4}$ W	R002	RM0254026	Variable Resist., 250K Ω (B)x2, Front Level
RD13	RK0203032	Variable, 20K Ω (B)	R003	RM0254026	Variable Resist., 250K Ω (B)x2, Rear Level
RD14	RK0503010	Variable, 50K Ω (B)	J008	YP0600029	Plug, with RCA Pin
RD15	RK0104015	Variable, 100K Ω (B)	J012	YJ0600027	Socket
RD16	RK0104015	Variable, 100K Ω (B)			
RD17	RC0000012	0 Ω , $\frac{1}{4}$ W	0126	275905701	Leg x 4
RD18	RC0000012	0 Ω , $\frac{1}{4}$ W	0128	51490410S	B. H. M. Screw, F. S. x 4
RD19	RC0000012	0 Ω , $\frac{1}{4}$ W	0329	288686101	Label, "Marantz"
			0330	951022101	Label, Fuse Caution
			0334	291086101	Label, Fuse Caution
CD01	EV1050352	PD01—CAPACITORS Electroly, 1 μ F, 35V	0407	51100306S	B. H. M. Screw, Terminal Board x4 B3x6
CD02	EV1050352	Electroly, 1 μ F, 35V	0408	51100306S	B. H. M. Screw, Reinforcement— Terminal Board x 4 B 3x6
CD03	EV1050352	Electroly, 1 μ F, 35V			
CD04	EV1050352	Electroly, 1 μ F, 35V	0429	51570306B	P. H. Tapt Screw, Reinforcement— Chassis x 4 P 3x6 ST
			0426	257816010	Bracket, Terminal Board Reinforcing
			0427	257816011	Bracket, Terminal Board Reinforcing
			0728	51100306A	B. H. M. Screw, Pushswitch x 6 B 3x6
HD01	HT313441E	PD01—MISCELLANEOUS Transistor, 2SC1344(E)	0729	51100306A	B. H. M. Screw, Power Switch B 3x6
HD02	HT313441E	Transistor, 2SC1344(E)			

REF. DESIG.	PART NO.	DESCRIPTION	REF. DESIG.	PART NO.	DESCRIPTION
0731	291012002	Insulator, on Scope VR	0109-	52017039J	H. Head Bolt, Display Plate x 4
1318	288710101	Support, Scope x 2	0111	290415404	Knob, Power Switch
1319	54040302N	Spring Washer Scope x 2	0112	281815401	Knob, Pushswitch (11φ) x 13
1321	51100304S	B. H. M. Screw, Scope Cover x 2 B3x4	0113	291015401	Knob, Scope (8φ) x 4
1607	51570306B	P. H. Tapt Screw, FM Front Board x 4 P3x6 ST	0116	282625701	Lid, Top
1609	291016006	Bracket x 3	0117	290911801	Spacer, NB Form x 2
1610	51570306B	P. H. Tapt Screw, Bracket x 3 P3x6 ST	0119	51480406S	B. H. M. Screw F., Top Lid Side x 4
1615	51570306B	P. H. Tapt Screw, AM Connector x 2 P3x6 ST	0121	282625702	Lid
			0123	51100406S	B. H. M., Screw x 8 B4x6
			0130	257711807	Spacer, Sticked on Bottom Lid x 2
1617	291016007	Bracket, AM P. W. Board	0302	291026501	Indicator, For U.S. A.
1618	51570306B	P.H. Tapt Screw, Bracket x 2 P3x6 ST	0310	51100305S	B. H. M. Screw x 2 B3x5
1620	291010104	Support, AM P. W. Board	0313	257886101	Label, UL Caution, For U.S.A.
1621	54050300R	T. L. Washer OR, Support (Bottom)	0314	257886102	Label, Do not remove cover.
1623	291010105	Support, AM P.W. Board	0315	257886103	Label, See marking on bottom.
1624	51100306B	B. H. M. Screw, AM P.W. Board x 2 B3x6	0316	250626506	Indicator, Do not use as handle.
1703	291027101	Holder, Partitioner x 2	0321	951091102	Label, UL Factory No., For U.S.A.
1704	51570306B	P. H. Tapt Screw, Partitioner x 4 P3x6 ST	0324	951110103	Label, UL, For U.S.A.
1705	54020301S	Flat Washer P., Partitioner x 4	0334	291086101	Label
1707	51100304S	B. H. M. Screw, P. W. Board x 4 B3x4	0622	281912005	Insulator
1709	51570308B	P. H. Tapt Screw, Connector x 4 P3x8 ST	0623	288420101	Partitioner, Dial Cover
1718	288716005	Bracket	0624	51570306B	P. H. Tapt Screw x 2 P3x6 ST
1719	51100305B	B. H. M. Screw x 2 B3x5	0711	285011202	Shaft
1721	288716006	Bracket	0712	54040402N	Spring Washer
1722	51100306B	B. H. M. Screw, Bracket x 2 B3x6	0714	291026901	Protector, Dial Pointer Lead Wire Cover
1802	51570408B	P. H. Tapt, Screw Transf x 4 P4x8 ST	0715	51100304S	B. H. M. Screw, Protector x 2 B3x4
1803	54020401A	Flat Washer, Transf. x 4	0718	56382540G	Eylet, Dial-Cord Threading
1804	54040402A	Spring Washer, Transf. x 4	0720	288700701	Strip, Below Dial, Black Rubber
1806	51570306B	P.H. Tapt Screw, R&L Reinforcement x 6 P3x6 ST	1630	291010909	Shield, Front End Cover
1811	291210105	Support, Molded x 5	1631	51570306S	P. H. Tapt Screw, Shield x 6 P3x6 ST
1819	291012001	Insulator, High-Voltage Cover	1716	290825901	Bush, Dial Pointer Lead Wire
1820	54020301E	Flat Wahser P, High-Voltage x 3	1724	288710904	Shield, Scope Cover
1821	51100305B	B. H. M. Screw, P, High-Voltage x 3	1725	51570306S	P. H. Tapt Screw, Shield x 4 P3x6 ST
1834	51570306B	P. H. Tapt Screw, Main Body-Chassis x 4 B3x5 P3x6 ST	1727	288700502	Clamper
1903	291010951	Shield K	1728	51100306S	B. H. M. Screw, Clamper x 2 B3x6
1909	281810107	Support, P.W. Board x 4	1729	54020301S	Flat Washer P., Clamper x 2
1910	51100304B	B. H. M. Screw, Lid x 4 B3x4	1734	291010908	Shield, MPX & Power
1911	51570306B	P.H. Tapt Screw, Shield-Chassis x 3 P3x6 ST	1735	51100306S	B. H. M. Screw, Shield x 4 B3x6
1912	54010300E	F. Washer S, PA01, Beneath Lid Support x 4	2102	291085101	Instructions, For U.S.A.
2003	291010501	Chassis	2109	291085601	Schematic Diagram, For U.S.A.
2005	288600502	Clamper x 2	2117	281885104	Instructions, Partitioner
2006	288600503	Clamper x 2	2118	288785108	Instructions, Accessory
2007	288600505	Clamper x 4	2120	282685107	Instructions, Cabinet Mounting
2009	138200503	Clamper x 4	2124	257785401	Guarantee Card
2010	51570306B	P. H. Tapt Screw x 4 P3x6 ST	2125	257785102	Instructions
2012	51570306B	P. H. Tapt Screw x 2 P3x6 ST	2126	257781301	Envelope, For U.S.A.
2013	54050300R	T. L. Washer OR x 2	2202	291080101	Packing Case, Inner
2014	62030039W	Lug	2203	291080111	Packing Case, Outer
2016	51570306B	P. H. Tapt Screw, Lug x 2 P3x6 ST	2208	288480301	Partitioner, Partitioner x 2
2019	291012301	Contacto	2212	901433533	Polyethylene Bag, Set
2020	291012302	Contacto x 2	2214	901302501	Polyethylene Bag, Printed Matter
2021	54050300R	T. L. Washer OR, Contacto x 3	2215	901302501	Polyethylene Bag, Accessories
2022	51570305B	P. H. Tapt Screw, Contacto x 3 P3x5 ST	2217	102980401	Sleeve, AC Cord
2030	138200503	Clamper x 2	2219	273182101	Silicagel x 2
2031	51570305B	P. H. Tapt Screw x 2 P3x5 ST	2220	281905601	Buffer, Antenna, Protector
2032	54050300R	T. L. Washer OR x 2	2222	952281501	Serial No Card x 4
L003	TS1860404	Power Transf., For U.S.A.	2231	ZA0200007	Ext. Antenna, FM
J006	YJ0600028	Socket, 10P	2233	ZD0120006	Connective Cord, Tuner
J010	YJ0700007	Socket, 22P			
J011	YJ0700013	Socket			

17. TECHNICAL SPECIFICATIONS

FM SECTION

Quieting Slope	1.7 μ V for 30dB, 5 μ V for 57 dB 10 μ V for 62dB, 50 μ V for 70dB
Ultimate Quieting	50 μ V for 70dB
Selectivity	Alternate channel, better than 85dB
Capture Ratio	Better than 1.5dB
Stereo Separation	40dB at 1KHz, 27dB at 15KHz
Total Harmonic Distortion	Stereo: Less than 0.3% Mono: Less than 0.2%
Frequency Response	\pm 1dB, 30Hz to 15KHz
Total Spurious Rejection	Better than 100dB
Image Rejection	Better than 100dB
AM Suppression	Better than 60dB
IF Rejection	Better than 100dB
Antenna Impedance	300ohm Balanced, 75ohm unbalanced
Quadradial Output	350mV, 15Kohms for \pm 75KHz Dev.

AM SECTION

AM Sensitivity	Better than 40 μ V
Selectivity	Adjacent channel, 1000KHz, better than 30dB
AM Bandwidth	(-6dB) 7KHz
Image Rejection	1400KHz, better than 70dB

GENERAL

Power Requirements	220V \sim 50/60Hz (This unit can be converted by a qualified technician to operate on 110/120/240V \sim 50/60Hz)
Unit Dimensions	Height: 5-3/8" (without feet)
Dimensions - Panel Width	15-3/8 inches
- Panel Height	5-3/4 inches
- Depth	11-7/8 inches
Weight - Unit alone	26.0 lbs.
- Packed for Shipment	32.6 lbs.

* These specifications and exterior designs may be changed for improvement without advance notice.



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NOTE

SERVICE INFORMATION FOR EUROPEAN MODEL

The information contained here in included the rear panel and main chassis component locations, schematic diagram, parts list, voltage conversion and FTZ regulations.

For the circuit description, alignment method and repairing hints, refer to the original service manual.

TABLE OF CONTENTS

Rear Panel Adjustments and Facilities Locations	36
Main Chassis Component Locations (Top View)	36
Schematic Diagram	37~38
Voltage Conversion	39
FTZ Regulation	39
Parts List	40

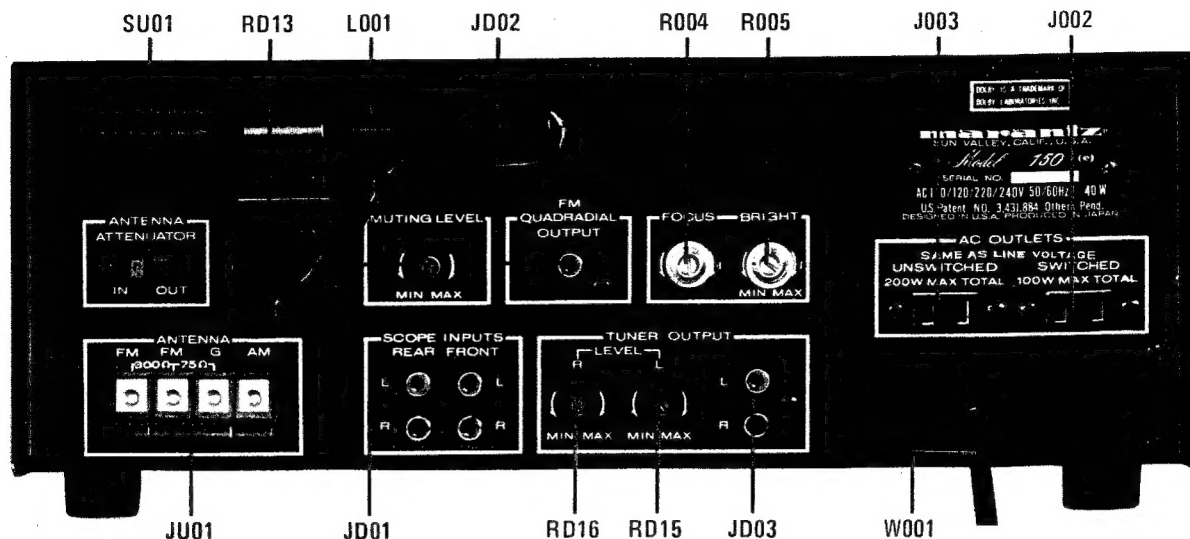


Figure 23. Rear Panel Adjustments and Facilities Locations

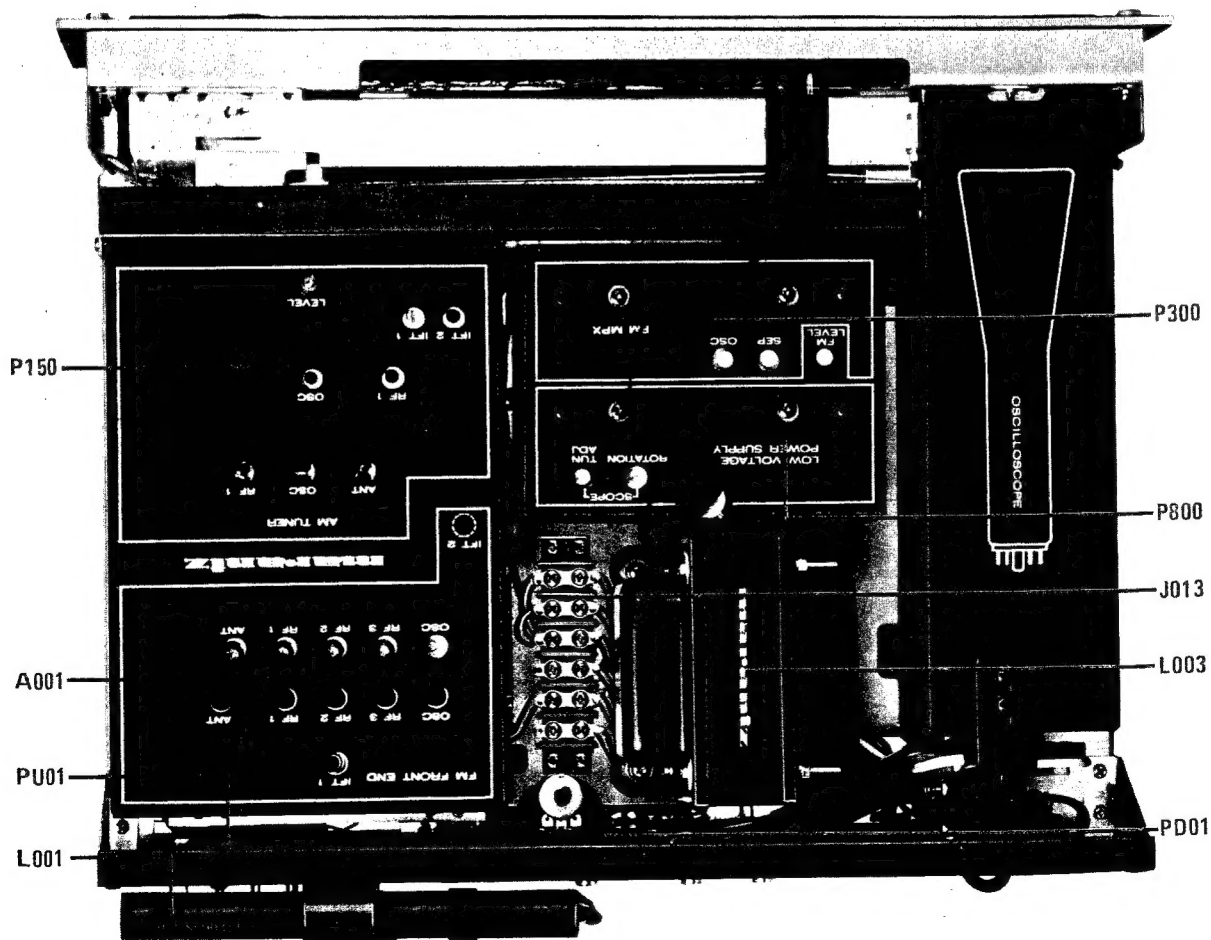


Figure 24. Main Chassis Component Locations (Top View)

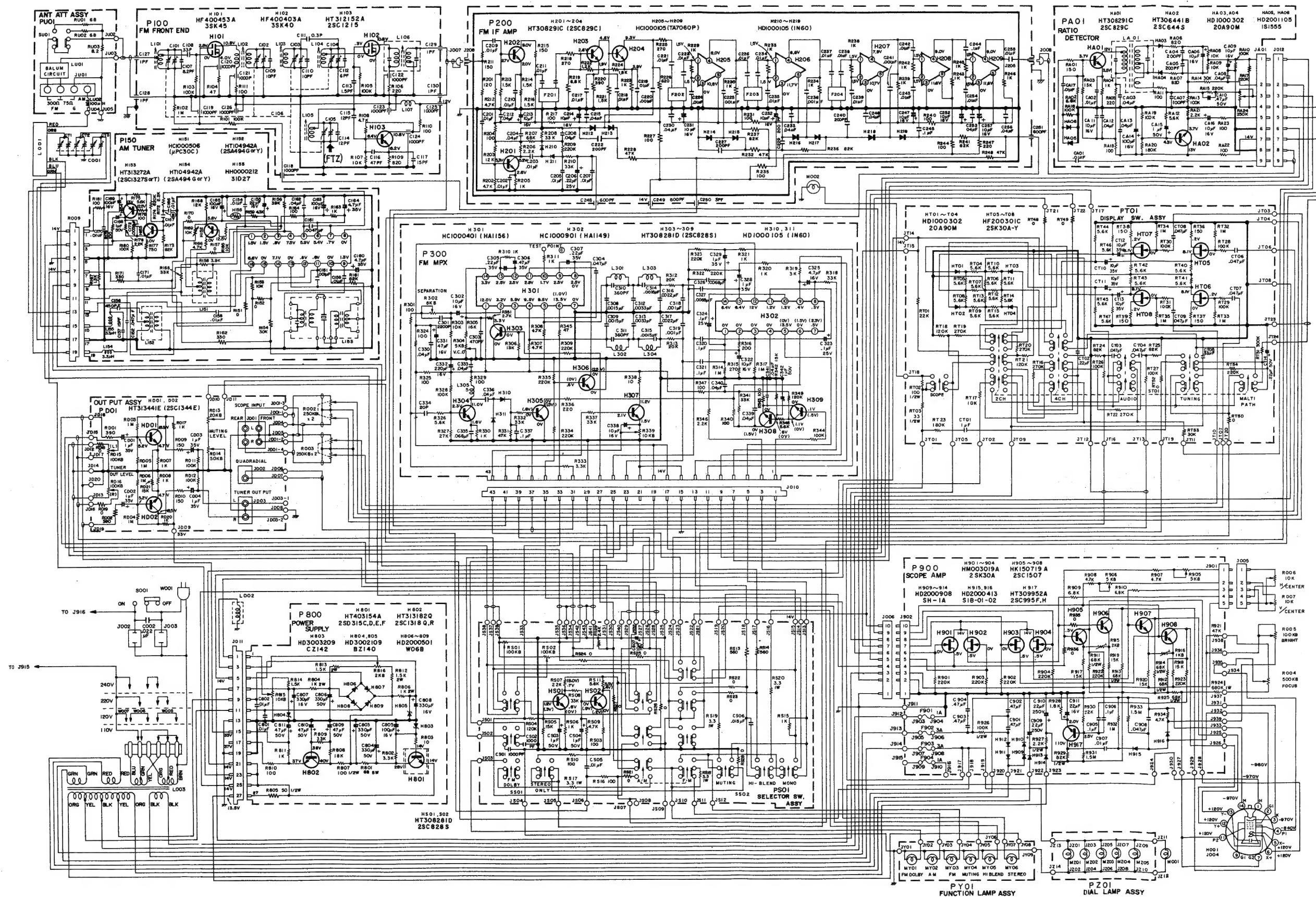


Figure 25. Schematic Diagram

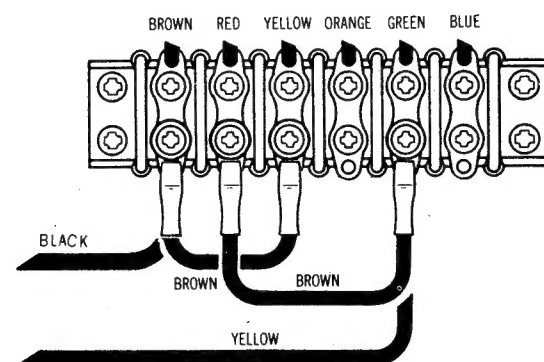
VOLTAGE CONVERSION

This model is equipped with a universal power transformer to permit operation at 110, 120, 220 and 240 V AC 50 to 60 Hz.

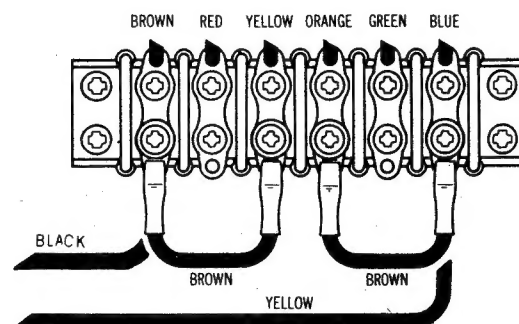
To convert the unit to the required voltage perform the following steps:

- (1) Remove the lid (top).
- (2) Change the jumper wires as illustrated below for the required AC voltage.

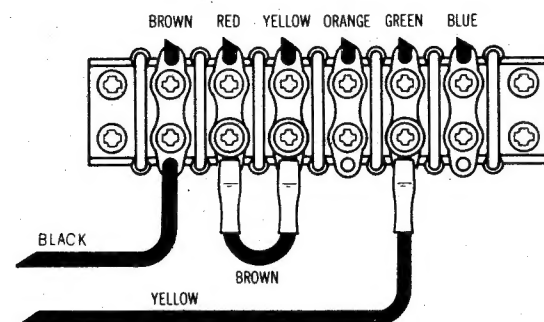
CAUTION: DISCONNECT POWER SUPPLY CORD FROM AC OUTLET BEFORE CONVERTING VOLTAGE.



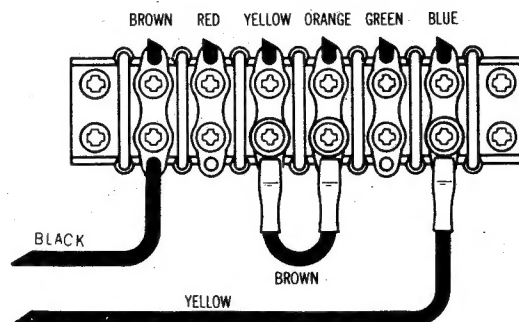
For 110V Operation



For 120V Operation



For 220V Operation



For 240V Operation

Figure 26. Voltage Conversion Chart

PARTS LIST

REF. DESIG.	PART NO.	DESCRIPTION
F901	FS1010090	Fuse, 1A
F902	FS1030090	Fuse, 3A
F903	FS1030090	Fuse, 3A
F904	FS1010090	Fuse, 1A
J903	YJ0800020	Socket
J910		
J915	YP1000113	Plug
J916	YP1000113	Plug
0403	291016022	Bracket, Terminal Board
0515	145525903	Bush, Power Cord Antenna
0516	284906702	Cap
0518	282125901	Bush
0519	53110303A	Hexagon Nut x 2
0520	54050300R	T. L. Washer x 2
0521	51060316A	P. H. M. Screw x 2 P 3x16
0522	55060305S	T. R. Rivet x 2
C002	DF1722380	Film Capacitor
S002	SP0101010	Pushswitch
2024	291016009	Bracket, Voltage Conversion Term.
2026	51570312B	P. H. Tapt Screw x 4 P 3x12 ST
2027	285412001	Insulator
2028	54060300R	T. L. Washer 1R x 5
J013	YL0106004	Terminal, Line Selector
L003	TS1860405	Power Transf.
0304	291026503	Indicator
2103	291085121	Instructions
2110	291085621	Schematic Diagram
2131	281881301	Envelope
2218	956000004	Hang Tag
2224	952301511	Serial No. Card x 4

*To be used in the European Model only.

FTZ REGULATION

Instruction for the use in the range other than specified in FTZ codes

Achtung für die Leute, die in dem Gebiet wohnen, wo die FTZ-Bestimmungen vorherrschend sind.

Sollte das Gerät auch für Frequenzen ausserhalb des in den FTZ-Bestimmungen angegebenen Bereiches empfangsbereit sein, bitten wir, den Bereich durch Nachstellen des Kernes in der Oszillatorschule (in der Abbildung mit "FTZ" gekennzeichnet) so zu korrigieren, dass er den Bestimmungen entspricht.